MAY 31 1924

Telephony

THE AMERICAN TELEPHONE JOURNAL

PUBLISHED EVERY WEEK
BY TELEPHONY PUBLISHING CORP.
608 S. DEARBORN ST., CHICAGO, ILL.

MAY 31, 1924. [VOL. 86. NO. 22.]

Entered as second-class matter Sept. 4, 1903, at the post office at Chicago, Ill., under act of March 3, 1879.

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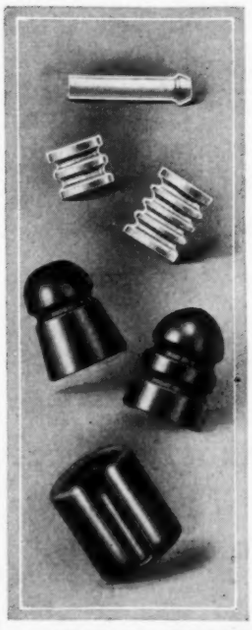

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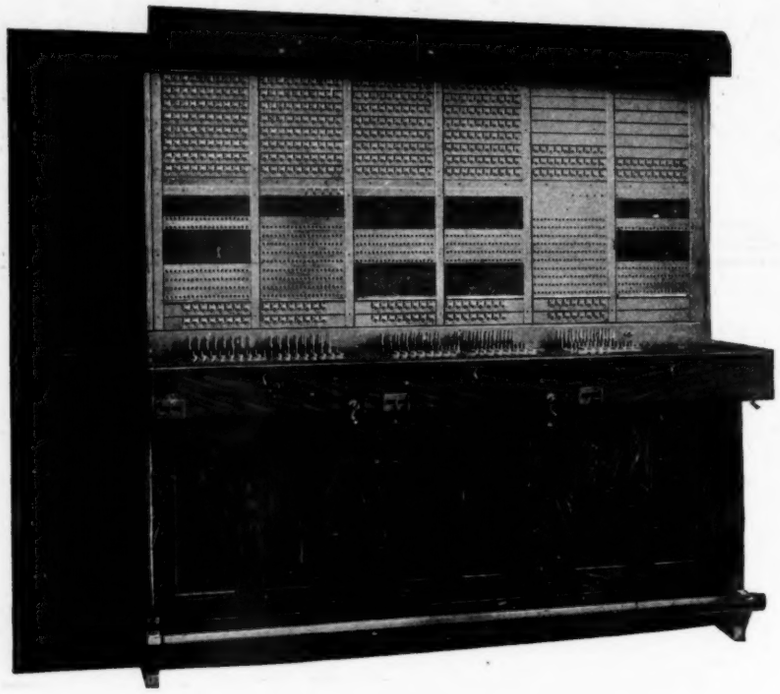

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Telephony.

THE AMERICAN TELEPHONE JOURNAL

Comprising Telephony, American Telephone Journal, Telephone Weekly, Telephone Magazine, Telephone Securities, The Telephone, Sound Wave
PUBLISHED WEEKLY BY TELEPHONY PUBLISHING CORP.
608 S. Dearborn St. Chicago

H. D. FARGO, President and Treasurer
S. R. EDWARDS, Editor and Secretary

J. R. HASTIE, Vice-President and Advertising Manager
H. D. FARGO, Jr., Western Advertising Manager

Entered as second-class matter September 4, 1908, at the postoffice at Chicago, Ill., under act of March 3, 1879.

Volume 86
Number 22

CHICAGO, SATURDAY, MAY 31, 1924

Subscription—10 Cents a Copy
$3 a Year U. S., Cuba and Mexico
$4 Canada, $5 Other Countries

LOCAL CONTROL AND GOOD WILL: NATIONALIZATION OF THE WIRES

That locally-owned and managed utility service companies enjoy a decided advantage in their closer contact with their communities is a fact that the students of "public relations" now concede. That contact, when properly utilized, means good will for the company, which is the foundation stone for satisfactory public relations.

Significant recognition of this condition was expressed in several of the addresses made before the convention of the National Electric Light Association at Atlantic City last week. One of these addresses, on the topic, "How Sound Public Relations Between Public Utilities and Communities Can Best Be Developed and Maintained," was delivered by B. C. Forbes, the writer on business and financial subjects.

* * * *

Usually Mr. Forbes is inclined to pat big business kindly on the back and say nice things about the financial giants of the East, but in his Atlantic City talk he frankly said that the Middle West, the South and the Far West are far ahead of the East in building up public relations that create good will and smooth the pathway of the service company.

This, he pointed out, is largely the result of local financial control and local management.

* * * *

In leading up to this thought, the speaker drew attention to the fact that the first, second and third prize winners in the article contest on public relations which he conducted in Forbes Magazine, live in Missouri and Illinois, and that the majority of all of the contributions submitted came from the Middle West and sections farther west.

His conclusion is that public service men in these parts of the country have addressed themselves more earnestly to winning the good will of the public than have the utility leaders of the East.

"What is the explanation?" he asked, and then proceeded to answer his own query as follows: "Utility companies in the Middle West, the Far West and the South are, generally speaking, either locally-owned and controlled or managed by local citizens."

Even the big utility companies in Chicago, Mr. Forbes said, have established a closer contact between their organizations and the people than have the New York corporations.

"Wall street capitalists," he said, "dominate numbers of very large utility corporations in the East. Such men have their offices, as a rule, in the financial section of New York. Most of them are rich.

"They have various irons in the fire. They are very busy men. Therefore, they live and move and have their being very largely in the financial atmosphere. They do not rub shoulders day by day with the rank and file of the people. They are not brought into close contact with the average householder or wage-earner."

The argument was continued that this situation leads Eastern companies to depend upon "inside influence with politicians to prevent passage of laws distasteful to them," whereas in other parts of the country the utility companies have learned the better way of getting on good terms with the public.

Additional evidence was presented in the statement that the idea of "customer ownership" was conceived and first put into practice in the West. This practical application of the local ownership principle, needless to state, has been a powerful factor in strengthening the standing of service companies in popular opinion and helping them to get a square deal.

* * * *

"Big business, high finance, capitalists everywhere, must realize that their future depends upon how they succeed, or fail, in earning the good will of the public," cautioned Mr. Forbes. "The day is rapidly approaching when that which is condemned by the public will not be allowed to live."

The locally-controlled telephone companies will appreciate the force of these statements, for they have avoided many of the troubles that have bothered others differently situated.

The obvious lesson is to keep on adding to the good will of their patrons.

* * * *

And now we have another appearance of our old acquaintance, government ownership of utilities!

The latest proposal for government

ownership and operation of the railroads and the telephone and telegraph systems of the country has materialized in the shape of a bill introduced in Congress by Representative Berger of Wisconsin. Inasmuch as its sponsor represents a party—the Socialists—which has just one member in Congress, it is not expected his bill will travel very fast—at least not in the direction of adoption.

* * * *

In these days, however, when the various blocs and irregular groups of radical lawmakers seem to influence legislation at Washington, the Berger bill may deserve some attention.

Briefly stated, it contemplates an issue of government bonds to acquire all the railroads, the telephone and telegraph lines and the private express companies. It provides a department of transportation and telegraphs to run the roads and the wires, and would put the express companies in charge of the postoffice department.

It also plans the creation of a commission to determine the physical value of these properties and fix a price for what the government is to take over.

Nine out of ten men will regard the Berger bill as a "pipe dream." The Wisconsin congressman asserts that "rate regulation has failed in the United States as it has in Europe."

His idea, of course, is that regulation is a "failure" because it has not always reduced rates, which reflects perfectly the distorted view of most demagogues looking for votes that rates should come down regardless of service, justice or anything else.

Representative Berger's reference to Europe is rather ill-timed in view of the fact that several countries over there are turning to private operation of railroads and telephone lines after an unsuccessful trial of government management.

The over-burdened taxpayers of the United States, without doubt, will decline to warm up to any plan to nationalize these vast utility enterprises at a public expense of probably not less than 12 or 15 billions. Add to that the inevitable waste of government administration and a deterioration of service, and the proposition will look still less attractive.

* * * *

The fact should not be overlooked that the job of appraising the value of the railroads, for government purposes, has been going on for years, is still unfinished, and Congress is now being asked to appropriate several millions to continue the work. The Berger bill aims to establish another commission to extend this gigantic task to the wire systems and express companies.

It seems queer how these experimenters are cheerfully willing to spend so much of the taxpayers' money to try out the schemes they claim will mean a saving for the "dear people."

COMING CONVENTIONS.

Wisconsin, Madison, Hotel Loraine, June 4, 5 and 6.

Washington, Puyallup, June 18 and 19.

Vermont, Fairlee, Lake Morey Inn, June 20 and 21.

Northern Indiana, Lake Wawasee, June 24, 25 and 26.

Indiana, Indianapolis, Claypool Hotel, September 17 and 18.

U. S. Independent Telephone Association, Chicago, Hotel Sherman, October 21, 22, 23 and 24.

Illinois, Peoria, Jefferson Hotel, November 12 and 13.

Proper Maintenance of Cable Plant

History of Development of Telephone Cable—Construction and Maintenance of a Modern Cable Plant—Necessity for Making Periodic Inspections—Some Suggestions for Preventing Trouble—Paper Presented at Minnesota Convention

By H. B. Nelson,

Cable Tester, Northwestern Bell Telephone Co., Minneapolis, Minn.

The history of the development of the modern telephone cable presents one of the most interesting subjects in our telephone industry. From the very beginning of the telephone business the early pioneers realized the necessity of concentrating the wires of the then rapidly-growing plants into smaller space.

As early as 1880 the streets of our eastern cities were being darkened by heavy pole leads and the roofs of the buildings were being covered by unsightly roof fixtures. This type of construction was costly and public sentiment demanded that the wires be placed underground.

It was only natural that our early telephone people should turn to the telegraph industry which had developed a successful cable for their purposes, in attempting to solve the needs of the telephone industry. The use of these telegraph cables for telephone purposes proved a failure, however.

Telegraph cables were insulated with rubber or gutta-percha, and the electrostatic capacity was so high that telephone conversations were badly muffled and distorted so as to become unintelligible. Furthermore, the fact that the wires were laid side by side in the core without any twist made it possible for conversations to be overheard from one circuit to another, a fault commonly known as crosstalk.

The reasons for their failures were not understood by our early telephone engineers. Speaking of this period Thomas A. Watson, Mr. Bell's earliest assistant says: "My recollection of all this work is chiefly characterized by a feeling of hopelessness I then had. I felt as if I were gazing into an abyss that must be bridged by lives of work and experiment before we could get to the other side."

The problem of putting wires into cables had to be solved, and the telephone engineers called in college professors of physics and electrical theory, to aid them in their experiments.

In 1882 this work had progressed to a point where they felt justified in warranting the expense of the construction of a cable five miles long, for experimental purposes. As the cost of placing this cable in the streets of a large city would be prohibitive, it was decided to lay the cable in the ground beside the railroad track between the stations of Attleboro and West Mansfield, Mass.

This cable consisted of 21 conducting wires, ten of which besides being perfectly insulated with rubber, were wrapped with tinfoil which was grounded to the outer sheath, it being the theory that tinfoil would kill the inductive crosstalk. Ten other wires were rubber insulated and twisted into pairs. The 21st wire was a No. 13 gauge parrafin insulated office wire. This core was drawn into sections

of lead pipe, each about 20 feet long; these sections being joined together by plumbers' joints.

Experiments with this cable were far from being satisfactory but it was decided to go ahead with the proposed underground system in Boston. Although these cables were only a quarter of a mile in length, they severely affected the clearness of speech when talking through them from stations located at suburban points.

The use of rubber insulated cable was followed by cotton insulated wire, drawn into iron pipe which was then filled with oil. This was followed by cotton insulated wire impregnated with a moisture-proofing compound, drawn into lead pipes of about 20 foot lengths and these joined together by plumbers' joints.

The next development resulted in the use of cable wire insulated with dry cotton, it having been found that cotton, baked dry so as to expel all moisture, was a good insulator if placed in a lead pipe and promptly sealed. This was an important development, as cotton had formerly been considered a bad insulator. Its use was a long step toward better transmission as it reduced the electrostatic capacity between the wires and sheath.

In 1887 the twisted pair construction was first used. This construction carried out the application of the transposed metallic circuit principle to cable, thereby eliminating crosstalk between the pairs in the cable. This improvement meant the abandonment of the entire existing cable plant and the introduction of the new type, without which the telephone system, as it is known today, would have been impossible.

More development work extending over a period of several years, constantly aiming to reduce the specific inductive capacity of insulating materials, led to experiments with paper twine. This proved too flimsy, but methods were devised for putting paper on the wire flat, crumpling it around the wire instead of winding it tightly. This resulted in the production of the best type of insulating material known for telephone purposes—dry paper, hermetically sealed, in a continuous lead sheath.

Successful Use of Paper Insulation

A cable of this type was first installed in 1890, and consisted of 50 pairs of No. 18 B & S gauge wire. The conductors, wound with loose paper, were really cushioned largely with dry air, the best insulator known. This was the best talking cable that had ever been manufactured.

In 1891 the use of No. 19 gauge wire was settled upon, subsequent progress in cable employing this size of wire being largely in the direction of increasing the number of wires that could be placed in a full sized sheath of about 2½ inches in diameter. This was accomplished chiefly through improving the insulating paper and the method of applying it. As a result, a cable of 100 pairs in 1892 had increased to 300 pairs in 1903 without increasing the outside diameter of the sheath.

The extraordinary increase in the number of telephone wires and the difficulty in many places in obtaining additional space underground led to the development of cables using smaller gauge conductors. No. 22 gauge cables were soon developed having 600 pairs of conductors, and in 1912 this was increased to 900 pairs in the same space formerly occupied by 600 pairs. In 1914 this was further increased by the development of a 1,200 pair, No. 24 gauge cable.

The economies accomplished by these improvements are not limited to the cables themselves but extend to the underground duct system, whose capacity is multiplied enormously by increasing the number of wires carried in a single cable.

The use of aerial cables started at about the same time that the first successful lead-covered cables were constructed. It was used to extend underground distribution and relieve the open-wire leads where the expense of conduit construction was not warranted.

The value of cable in aerial construction was soon demonstrated, as it brought about a cheaper construction and maintenance cost. The modern aerial cable plant is now making use of all sizes of cables up to 600 pairs, No. 24 gauge, and the placing of terminals at each pole in city distribution has eliminated the use of open wire leads.

The development of underground conduit systems was more rapid than that of cable. Some of the first cables were laid in ducts built of planks, the cable being laid in a box filled with dry sand and the whole box being covered with tar or bitumen compound. This method made it impossible to add additional or remove defective cables without tearing up the streets and was soon replaced by a system in which cable could be drawn in from pull boxes or manholes.

The ducts were constructed of iron pipe, hollow tile, or creosoted wood pumplog. The use of iron pipe has now been discontinued except where serious underground obstructions are met and the space required for other types of construction is impossible to obtain.

Iron pipe will rust, which makes it very difficult to remove old cable or to pull in new; and in our northern states where the frost goes down below the level of the duct line, ice forming in the duct will often crush the lead cables. This does not occur in hollow tile or pumplog as the expansion of the ice caused by freezing is taken up in the conduit and no damage to the cable results.

One of the most successful and economical ducts is the multiple, vitrified clay duct. These are manufactured in multiples of one, two, four and six ducts, and are being used in the construction of main duct lines. Creosoted wooden pumplog makes an ideal duct for single lateral, and is used wherever the initial cost is less than the cost of single tiles.

The manufacturing of lead cable is one of the most interesting processes in the industry. The selection of raw materials is of the greatest importance. The copper which is employed in the manufacture of telephone cables, must be pure in order that the wires may have uniform resistance and be free from corrosion.

The paper for insulation is made from the best manilla rope stock and must be free from acids and corrosive salts that might attack the wires after the cable is assembled. The lead and alloying metals that are used to form the sheath or lead armor must be carefully selected in order that the core of the cable shall be full protected from moisture and corrosion.

Steps in Manufacture of Cable

The first process in the manufacturing of cable is that of placing the paper insulation on the single wires. On the proper application of this paper depends the final transmission qualities of the cable. In order to get the best results the electrostatic capacity must be kept at the lowest possible point.

This is accomplished by twisting the flat paper spirally about the wire, at the same time crumpling the paper so as to leave the wires suspended in a series of air pockets. The single wires are then twisted into pairs, the length of the twist varying according to the gauge of the wire used. The pair wire is now assembled on the stranding machine which forms the cable core.

These stranding machines vary in size according to the number of pairs the cable will actually have. If a 200-pair cable is to be made, the machine will be capable of handling 202 reels of paired wire.

The core is built up in layers, each layer being wound spirally around the core in the opposite direction from the preceding layer. As each layer is laid in place on the core, it passes through a steel die which compresses the core to its proper size and smooths out each layer as it is wound into place. After passing through the last die, the core is wound with a double layer of heavy paper to protect it from the sheath.

The cable is now ready for its first test. The wires are tested for opens and crosses and any defects found are repaired before the sheath is put on. When the preliminary tests are made and the defects are repaid, the core is placed in drying ovens, where it is subjected to a temperature of from 215 to 230 degrees for a period of from 15 to 48 hours depending upon the size of the cable.

After being thoroughly baked, the core is placed in other drying ovens in which

the temperature is somewhat reduced. These ovens are situated directly behind the lead presses, the machines which place the lead armor on the core.

The composition of the lead armor or sheath is one of the most important items in lead cable. Early in the use of lead cable it was found that pure lead did not possess the requisite corroding-resisting and strength properties for either underground or aerial use.

Aerial cables are continually subjected to vibration which soon caused crystallization and lead to a leaky sheath. This was first overcome by alloying the lead with 3 per cent of tin. The rising cost of tin materially increased the cost of cable and after a long period of tests and experiments with different combinations of alloys, it was found that the addition of a small amount of antimony to the pure lead would produce an alloy that was entirely satisfactory for use as cable armor This new alloy has resulted in an enormous saving in the initial cost and maintenance of cable plants.

When the core is ready to be sheathed, it is fed directly from the drying ovens to the lead presses, which form the lead sheath about the core by hydraulic pressure. These presses are designed so that the enormous pressure which is necessary to form a perfect lead sheath from the plastic lead is not exerted directly on the core of the cable but parallel to it and results in no compression of the wires or insulation.

As soon as the cable is cooled sufficiently to handle, it is subjected to the final tests. The wires are first tested for crosses, grounds and opens, and all defective wires are properly marked. It is then subject to galvanometer tests to determine whether the cable possesses the proper electrostatic capacity to conform to the specifications under which it is being manufactured.

The final test is the breakdown test and all wires must pass successfully a pressure of 500 volts. The ends of the core are then sealed with paraffin and the open end of the sheath is soldered tight, after which the cable is ready for shipment.

Plan for Cable System First Step

The first step in any construction program is to draw up a definite plan of procedure. The fundamental plan is designed to provide a general basis for a continually economical construction program for future extensions to the plant of a growing system, so that the whole may work at a reasonable degree of efficiency and at the same time yield a fair return on the investment.

To this end the plan must provide for concentrating the subscribers' lines into one or more main cable feeders with the least amount of subsidiaries whether they be of open wire or small cable. The main feeders must be planned over the most direct route to the central office, using diagonal streets or alleys wherever possible. The economy of using the greatest number of pairs in a single cable sheath and a high degree of copper efficiency are thus obtained. In so planning, the maximum use of existing plant and a minimum loss due to removal of good plant must essentially become a part of the problem and a large portion of its correct solution.

In the engineers' preparation of the fundamental plan, the merits of several favorable future plans must be studied as to cost, together with the existing plant and the trend of the expected growth, so that the various stages of addition will link together to form a flexible and economical layout at all times. When this study has been completed, the amounts of new money required and the net revenue expected can be estimated with a favorable degree of accuracy.

The joint use of poles by electric light and telephone companies where the power voltage is less than 5,000 volts is one of the fundamentals of good engineering. Separate pole lines on the same side of a street or alley, or on opposite sides of the same street or alley, not only result in many cases in serious conflicts, but are more expensive as to first cost, maintenance and replacement. Hazardous and unsightly conditions often result in unfavorable public attitude and the demand for the placing of underground construction or expensive reroutes could be long delayed or entirely avoided by one well-constructed pole line.

The accidental contacts between the telephone and electric wires are reduced by joint construction to a minimum, and the resultant economy in maintenance for both companies is readily seen. Usually when the two companies operate on a conflicting basis, it is necessary for one to use poles from five to ten feet higher than the other company in order to obtain reasonable clearance. It has been found entirely practicable, particularly in alley or on private right-of-way, to use 30-foot poles except at streets where 35-foot poles are used to obtain clearance over the crossing.

It will thus be seen that poles not more than five feet higher will be required than would normally be planned. A separation of 72 inches should be maintained between the power wires and the telephone plant on all joint construction and should never be less than 40 inches. There the separation is less than 72 inches above the cable messenger and electric attachment, a guard arm should be placed just above the telephone messenger to prevent workmen from coming in contact with grounds while working on power wires.

Where duplicate pole leads are in use and either company finds it necessary to rebuild or extend its lines, either in a small section or on a large scale, every effort should be made to secure the advantages and economies available by cooperation in the joint use of poles.

In the first place, the construction of telephone pole lines, conduit lines, placing and splicing of cable are in no way different than the placing of a foundation for a skyscraper building, for if such a building is to remain for a satisfactory period in a good condition, it necessarily follows that the building must be constructed upon a solid foundation. This is equally true of the telephone plant.

Poles when set should be placed the proper depth and securely tamped to insure their staying in their proper position under a reasonable load. Otherwise such pole lines would be expensive to keep in shape as it would be necessary from time to time to straighten and retamp them and rearrange such overhead construction as they might support.

Proper Construction of Pole Lines

Pole lines, constructed to support aerial cable, should be securely anchored and guyed, and where the guys or messenger are dead-ended around the poles, the poles should be protected with metal shims to prevent the strands from cutting into the poles and slacking off, as the life of an aerial cable depends largely on keeping the cable as free from vibration as possible.

The necessary city and other permits should always be secured before starting either aerial or underground construction so as to avoid any misunderstanding or ill-feeling on the part of the city officials or property owners. Poles and anchors should be placed, insofar as possible, on property lines when first placed, so as to avoid future expense of moving them due to property owners constructing garages and similar buildings with doorways opening where our poles and anchors are located, this difficulty being rarely experienced when poles and anchors are placed on property lines.

Temporary work should be avoided, insofar as possible, for in the long run it is more expensive than doing the job permanently and generally there is nothing to prevent doing a permanent job in the first place. It may become necessary on exceptionally big storm jobs to do some temporary construction work, but even on such a job it is generally more economical to do most of the work permanently.

Construction work should be carried on so as to prevent accidents to persons and damage to property. This often necessitates special care and methods and some additional expense, but it pays in the long run. When constructing pole lines, or underground conduits, signal flags should be placed or men stationed to warn

the public of the work being done. Care should be taken when working on or adjacent to lawns, shrubbery, trees and fences not to damage such property.

The best poles available for the particular job at hand should be selected for corner locations and terminating points, as the greatest strain comes on these poles. When poles are delivered to the job they should be placed as close as possible to the permanent location, as this effects a considerable saving in time by the pole-setting crew.

In placing messenger strand on poles, great care should be taken to prevent the messenger from coming in contact with light or trolley wires, and to place it high enough so that the cable when installed will have sufficient clearance from such light or trolley wires. The cable rings and a fish wire should then be placed, after which a pulling-in rope may be pulled through the rings. The cable reel should then be mounted about 30 feet from the pole where the cable is to be run onto the messenger.

The pulling-in rope should be passed through an aerial cable guide attached to the messenger about two feet from the pole and attached to the end of the cable by means of a small size, woven-wire grip, or by means of a core hitch. The core hitch consists of removing about two feet of armor and using the cable wires to fasten the cable to the pulling-in rope.

The actual pulling-in of the cable can now be started. Two men should be located at the reel to see that the cable reels off properly, and other men should be stationed along the section to see that the cable does not catch on rings or pole attachments. The power for pulling may be supplied by winch power or truck, by hand capstan, or by horses, depending upon the amount of cable to be pulled in and the apparatus available. After the cable is in place, open ends should be sealed up promptly to prevent damage from moisture.

As soon as the cable is placed on the pole or in the underground ducts, the cable splicer is moved onto the job to connect it up. The cables are first bent into the proper position and the sheath removed from the ends. A serving of muslin or cotton tape that has been freshly boiled out in hot paraffin is then placed around the core of the cable and forced back in under the sheath to protect the conductors from being grounded on the end of the sheath.

The loose ends of the core are then boiled out in hot paraffin, heated to a temperature of from 375 to 400 degrees. When boiling out, the paraffin should first be applied to the sheath about six inches from the open end of the cable until the cable is thoroughly heated. The paraffin is then gradually poured on the core, moving the heated wax toward the loose end and driving any traces of moisture away from the sheathed part of the cable. This operation is very important and should be repeated every 300 pairs when large cables are being spliced.

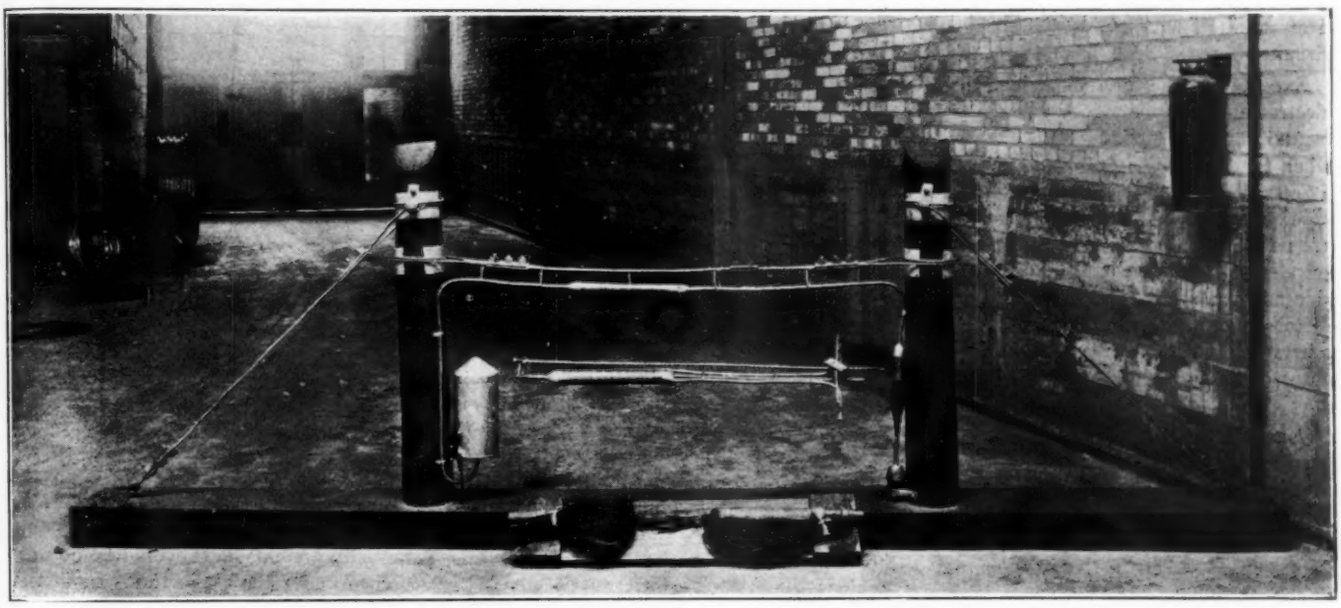
The wires are then pigtailed together and a boiled-out cotton tube is placed over each spliced wire. When all wires are connected together, the splice is boiled out with hot paraffin, wrapped tightly with a freshly boiled-out muslin bandage and again boiled out. The lead sleeve is then slipped over the splice, the ends bent in and joined to the sheath with wiped plumbers' joints. The splices are then securely tied to the messenger and branch cables, if any, lashed to the main cable at the Y end of the splice with marlin or No. 16 gauge copper tie wire.

In splicing up extended aerial cable, it is the practice to splice up the branch laterals, first beginning at the end terminal and working back to the main cable. The lateral cables are then spliced to the proper group of conductors in the main cable, and the final tag splice, in which all wires are properly identified, is made near the underground terminal or just outside the central office.

The maintenance of a modern telephone cable plant may be well compared to the principle of preventive dentistry which has become established by all far-sighted people. We do not wait until we have a toothache before we go to the dentist, but at regular periods have the dentist inspect our teeth and repair such minor defects as might have developed and save extraction or extended work. We believe this same principle applies to the proper maintenance of the telephone plant.

The quality of telephone service furnished by any exchange is largely reflected by the condition of the plants furnishing that service. To the outsider, the question of poor service brings up a comic picture of an indifferent operator reading a book and chewing gum. To a telephone man this picture is false, for we are well aware that our traffic forces are keen to serve the subscriber if they have half an opportunity. As our cable plant furnishes one of the main links between the subscriber and operator, it is necessary that we plant men devise means for preventing the interruptions that might occur.

Up until recent years it had been the practice to wait until a cable failure occurred and then call in a cable man to locate and clear the fault. This resulted in serious interruptions of service. In many cases the trouble disappeared before the cable man arrived, only to reappear after the next rain. (*Please turn to page 32.*)



Miniature Telephone Line Exhibited to Show the Proper Installation of Aerial Cable, Guying of Poles, Etc.

Induction from High Power Parallel

An Analytical Method of Making an Estimate of Voltage Induced in an Open-Wire Telephone Circuit of an Ohio Company Over a Seven-Mile Exposure by a 66,000-Volt, Three-Phase Power Line Having No Transpositions

By F. A. Puchstein,
Associate Engineer, Snook-Hillhouse Co., Columbus, Ohio.

At the request of one of our clients we recently made an estimate, by analytical methods, of the voltage that would be induced in an open-wire telephone circuit by a 66,000-volt, three-phase power transmission line, having no transpositions, over a seven-mile exposure. Fig. 1 shows the relative positions and spacings of the conductors in the parallel power and telephone circuits.

Except for the line charging current, electromagnetic induction due to a fundamental harmonic of current exists only when the power line carries a power load. Effects due to power load unbalance, harmonics, residuals and unequal wire spacing are neglected, as is also the effect of wave spiralling and the very small conductor, skin and proximity effects. The last three factors are negligible in this case. The others are not readily accessible for purposes of analysis.

The wires are assumed to be mere points. If stranded, a further slight correction may be made. The effect of charging current in the power line is neglected.

Before we can begin the analysis it is necessary to have certain laws. These are:

(1) Magnetic density = permeability × magnetizing force,

$$B = \mu H$$

(2) Magnetic flux = magnetic density × area of path,

$$\phi = AB$$

(3) Induced voltage = constant × rate of change of magnetic flux with respect to time,

$$e = -k\frac{d\phi}{dt}$$

(4) Magnetic density produced at any point, *P*, in the vicinity of an isolated conductor carrying a current of *I* amperes = constant × current ÷ distance, *r*, of the point from the center of the conductor. When the conductors are in a non-magnetic medium, this density is

$$B = \frac{.508\,I}{r}.$$

(5) The interference voltage set up in the wires, *a*, *b*, (Fig. 2) is proportional to the quantity of magnetic flux set up between them. To calculate this, multiply the flux density, $\frac{.508I}{r}$, by the element of path area $L\,dr$ (read "*L* differential *r*") and take the sum of all such elementary products (this an infinite number).

It is possible to perform this operation step-by-step and obtain an approximate result. I will here use the exact result as obtained by the methods of integral calculus:

Flux between conductors *a-b* due to current *I* in *C*

$$= \phi = L \int_{r_1}^{r_2} \frac{0.508I}{r}\,dr$$

$$= .508LI \text{ log. } r_2/r_1$$

$$= 1.17LI \text{ log. } 10\,r_2/r_1$$

L is the length of exposure in inches:

$= 7$ miles

$= 7 \times 5{,}280 = 36{,}960$ feet

$= 36{,}960 \times 12 = 443{,}500$ inches

The *load* on the three-phase line was not given, so we will assume that it carries 9,150 kilowatts at a power factor of 80 per cent. This will give a current of

$$I = \frac{P}{\sqrt{3}E\cos\phi} = \frac{9{,}150 \times 1{,}000}{\sqrt{3} \times 66{,}000 \times .80} = 100 \text{ amperes per wire.}$$

In an alternating current line, the current is not steady and constant—even though the load be constant, as is here assumed—but it varies at an ever-changing rate throughout the cycle and reaches a maximum value of $\sqrt{2} \times 100 = 141.4$ amperes.

The method of taking this action into account will be shown presently for the case where *neither circuit is transposed*. If the three conductors, *A*, *B*, *C*, could be placed so close together as to become substantially a point, there would be no interference under the assumptions of this exposition.

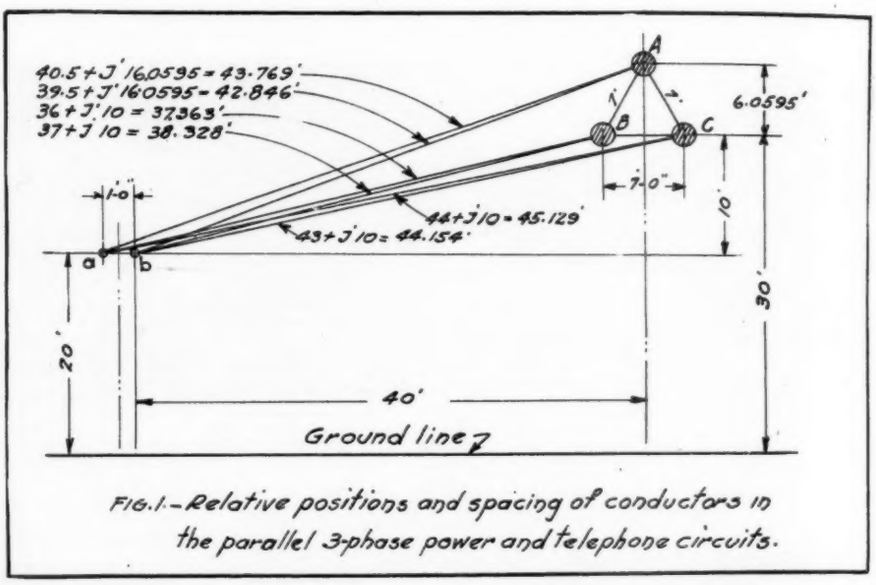


FIG. 1.—Relative positions and spacing of conductors in the parallel 3-phase power and telephone circuits.

Also, in a three-phase line, the current in each wire at any instant is different and changes at a different rate. This will be taken into account at the proper place.

Maximum cyclic fluxes produced between the conductors, *a-b*, of the telephone line by the power line conductors, *A*, *B*, *C*:

By conductor *A*,

$$\phi_{Am} = 1.17^* \times 443{,}500 \times \sqrt{2} \times 100 \times \log_{10}\frac{43.769}{42.846} = \sqrt{2} \times 51{,}850{,}000 \times 0.00926 = \sqrt{2} \times 480{,}000 \text{ lines.}$$

By conductor *B*,

$$\phi_{Bm} = 1.17 \times 443{,}500 \times \sqrt{2} \times 100 \times \log_{10}\frac{38.328}{37.363} = \sqrt{2} \times 51{,}850{,}000 \times 0.01108 = \sqrt{2} \times 575{,}000 \text{ lines.}$$

By conductor *C*,

$$\phi_{Cm} = 1.17 \times 443{,}500 \times \sqrt{2} \times 100 \times \log_{10}\frac{45.129}{44.154} = \sqrt{2} \times 51{,}850{,}000 \times .00949 = \sqrt{2} \times 492{,}000 \text{ lines.}$$

*More accurately 1.1697.

To follow the action at this stage, it is necessary to use a vector diagram.

In Fig. 3 instantaneous values of the in-

terference fluxes between the conductors of a telephone circuit, due to the currents in a three-phase power line, are shown. At 60 cycles per second, the circle in Fig. 3 rotates about its center O at a speed of 60 revolutions per second. The vertical dimension lines, Fig. 3, represent the value and direction of the interference flux due to any power line conductor at any instant of time.

In Fig. 4 is shown the direction of the interference fluxes at the instant represented in Fig. 3.

The resultant interference flux can now be given as the algebraic sum of the separate fluxes, or its instantaneous value:

$$\phi = [480{,}000 \sin (2 \times \pi \times 60 \times t) + 492{,}000 \sin (2\pi \times 60t + 120°) + 575{,}000 \sin (2\pi 60t - 120°)] \sqrt{2}$$

At this stage we must expand the sum and difference of two angles, thus, $\sin (a \pm B) = \sin a \cos B \pm \cos a \sin B$. When applied to the above expression, it becomes,

$$\phi = [480{,}000 \sin (2\pi ft) \pm 492{,}000 (\sin 2\pi ft \cos 120° + \cos 2\pi ft \sin 120°) + 575{,}000 (\sin 2\pi ft \cos 120° - \cos 2\pi ft \sin 120°)] \sqrt{2}$$

$$= [480{,}000 \sin wt - 246{,}000 \sin wt + 426{,}000 \cos 2\pi ft - 287{,}500 \sin wt - 49{,}800 \cos wt] \sqrt{2}$$

$$= [-53{,}500 \sin wt - 63{,}000 \cos wt] \sqrt{2}$$

$$= -82{,}600 \sqrt{2} \sin (wt + 49° 40').$$

To find the volts induced in the telephone circuit, it is necessary to differentiate this expression (by the methods of differential calculus), whence the rate of change of flux at any instant,

$$\frac{d\phi}{dt} = -82{,}600 \sqrt{2} \times 2\pi 60) \cos (wt + 49°40')$$

$$= -31{,}150{,}000 \sqrt{2} \cos (wt + 49°40')$$

lines per sec.

The induced volts, since the telephone circuit is a coil of one turn and a rate of change of 10^8 lines per second induces one volt,

$$e_m = -k\frac{d\phi}{dt} = \frac{-N\, d\phi}{10^8\, dt} = \frac{1}{10^8} \times 31{,}150{,}000 \sqrt{2}$$

$$= \sqrt{2} \times 0.3115/\text{volt max.}$$

$$= \sqrt{2} \times 0.3115/139°40'$$

This is strong enough to be fairly prominent when the line carries a load. It can be reduced by using a smaller power load, by placing the power wires closer together (would not be permissible), by placing the lines farther apart, by placing the telephone wires closer together, or by placing the telephone wires in the position, so far as this factor is concerned, of least interference. This is about as shown in Fig. 5.

Transposition of both circuits where the transpositions are properly coördinated, is the most effective method for reducing the trouble due to the effects considered under this head, except when the telephone wires are placed within a metallic sheath made of a magnetic material.

Electrostatic induction due to a fundamental harmonic of voltage exists only when the line is alive and is independent of the current or load, except in a minor way, as these cause a small change in the voltage and in its distribution.

If a conductor be charged with Q micro-coulombs per mile, there will be produced an electrostatic field in the space surrounding it. This field has a value at any point of $11.2\ Q/r$ volts per inch.

If two conductors, a and b, of a tele-

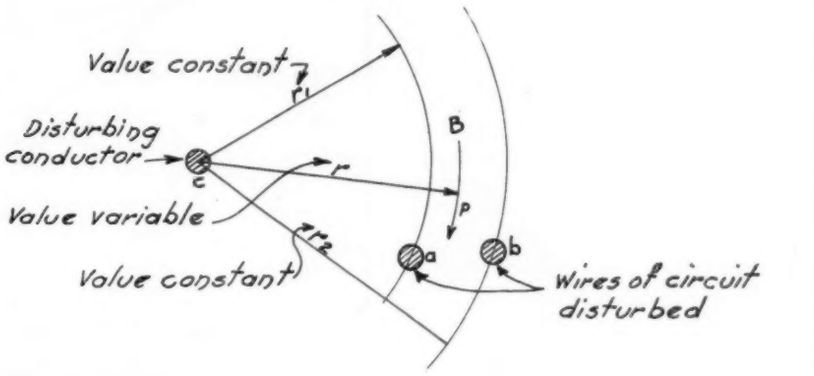


FIG. 2- Manner in which a disturbing magnetic flux is set up between the wires of a telephone circuit by a current in a neigboring conductor.

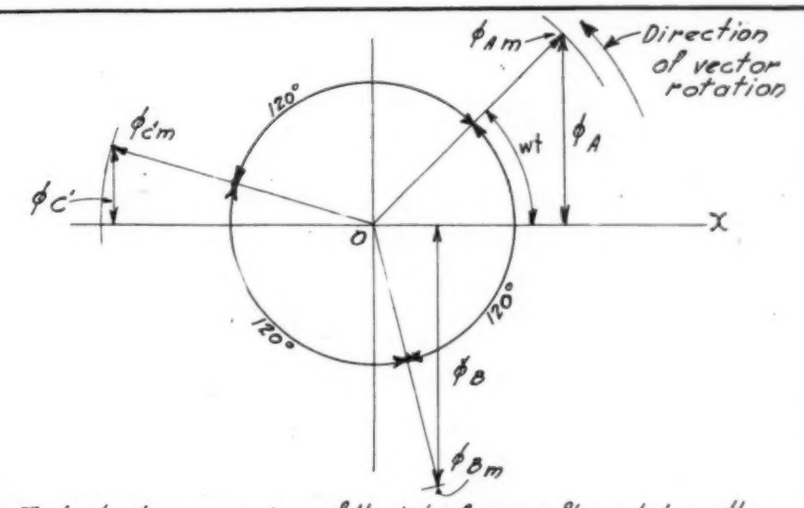


FIG. 3.-Instantaneous values of the interference fluxes between the conductors of a telephone circuit, due to the currents in a 3 phase power line.

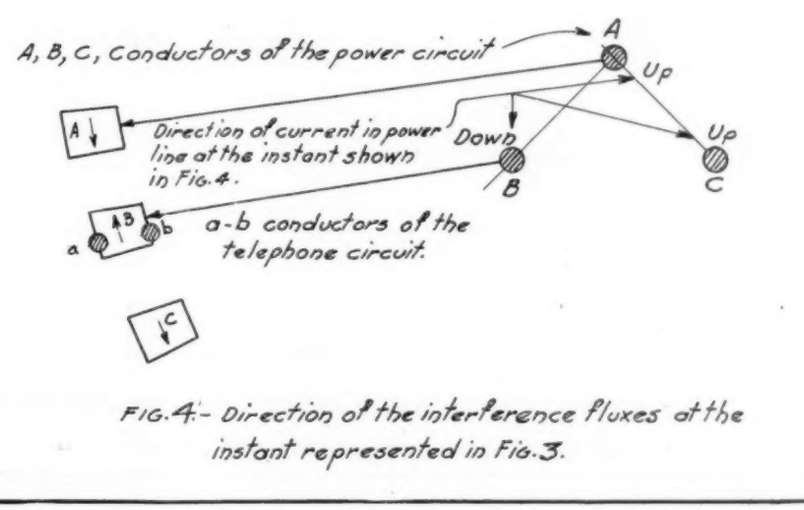


FIG. 4.- Direction of the interference fluxes at the instant represented in Fig. 3.

phone circuit are in the vicinity, the voltage induced between them is found by summing up the elementary voltages for all points between the limits, r_1 and r_2, or Volts between a-b due to a charge Q on C

$$= \int_{r_1}^{r_2} \frac{11.2Q}{r}\,dr$$
$$= 11.2Q \log_e r_2/r_1$$
$$= 25.75Q \log_{10} r_2/r_1 \text{ volts.}$$

Referring to Fig. 1, the voltages induced between a by the three-phase charges on A, B, C, is the algebraic sum of the separate effects, or

$$\text{Volts} = 25.75Q_{Am} \log_{10}\frac{43.769}{42.846} \sin wt + 25.75Q_{Cm} \log_{10}\frac{45.129}{44.154} \sin (\text{wt} - 120') + 25.75Q_{Bm} \log_{10}\frac{38.328}{37.363} \sin (wt - 120°).$$

If the three-phase conductors have a mutual capacity of C microfarads per mile, the charge $Q_m = Q_{Am} = Q_{Bm} = Q_{Cm} = Ce_m$, where e_m is the voltage (cyclic maximum) of the power line taken to neutral. We can represent the condition as shown in Fig. 7, where

$$C = \frac{.0447}{\log_e d/a} = \frac{.0194}{\log_{10} d/a} \text{ microfarads}$$

per mile, and charging current, $I_c = WEC = WE\frac{.0194}{\log_{10} d/a}$. Or we can replace C' by a Y-connected system, Fig. 8, in which $C' = 2C'$ (to neutral) and the voltage $E/3$ so that the charging current $= \frac{0.2C'E}{\sqrt{3}} =$ 1.15 $C'E$ or 15 per cent larger than for one-phase, as it should be.

Take a power conductor diameter of 0.3", radius 0.15", then

$$C = \frac{0.0194}{\log_{10} 84/0.15} = \frac{0.0194}{\log_{10} 560} = \frac{0.0194}{2.748}$$
$$= 0.00706 \text{ microfarads per mile; and}$$

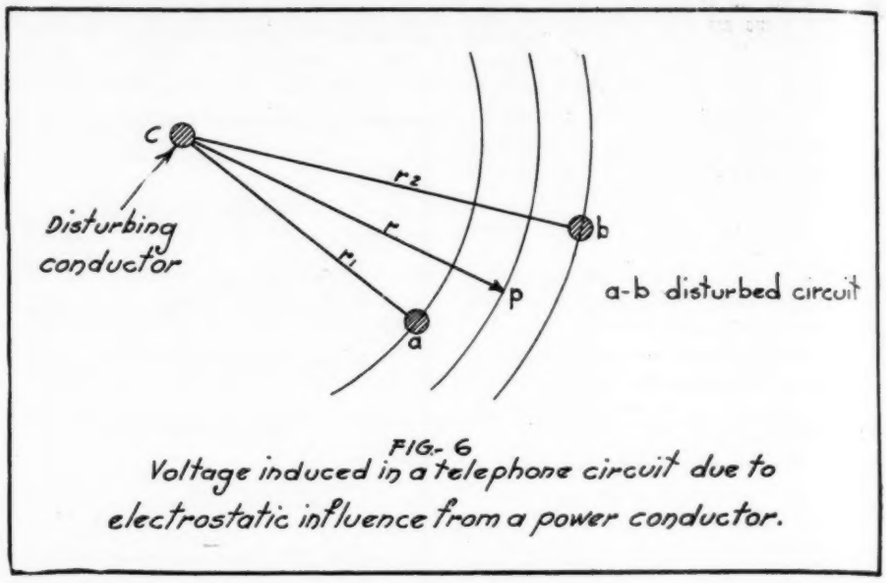


FIG. 6
Voltage induced in a telephone circuit due to electrostatic influence from a power conductor.

$$e_m = \frac{660{,}000 \times \sqrt{2}}{\sqrt{3}} = 53{,}900 \text{ volts to neutral}$$

electrostatic induced volts (maximum cyclic value).

$$\begin{array}{l} = 25.75 \times .00706 \times 53{,}900 \times .00926 \times \sin (wt + 36°50') \\ + 25.75 \times .00706 \times 53{,}900 \times .01108 \times \sin (wt + 156°50') \\ + 25.75 \times .00706 \times 53{,}900 \times .00949 \times \sin (wt + 63°10') \end{array}$$

(C, e_m, Log)

$$= \left\{ \begin{array}{l} 90.8 (\sin wt \cos 36°50' + \cos wt \sin 36°50') \\ 108.5 (\sin wt \cos 156°50' + \cos wt \sin 156°50') \\ 93.0 (\sin wt \cos 63°10' - \cos wt \sin 63°10') \end{array} \right\} =$$

$$= \left\{ \begin{array}{l} 72.6 \sin wt + 54.5 \cos wt \\ 99.8 \sin wt + 42.7 \cos wt \\ 42.2 \sin wt - 82.9 \cos wt \end{array} \right\}$$

$= 15 \sin wt + 14.3 \cos wt = 20.7 \sin (wt + 43°40')$ volts (maximum cyclic value) $= 20.7 \angle 43°40'$ volts.

We may make the further observation that in all of the foregoing work the effects due to the presence of earth, metallic objects, insulating materials with properties differing from those of the air, etc., have been neglected.

Also, the writer has not at hand any figures to show at what values the interference becomes prohibitive, either from the standpoint of noise, or from the standpoint of excessive voltages between telephone circuit and ground. The figures indicate that a carefully worked-out scheme of transposition for both power and telephone lines is necessary and that considerable care must be taken to see that the voltage between telephone and ground is kept down to a safe value.

The actual voltage induced between the telephone wires when these are open at one or both ends is the vector sum of the voltage due to electromagnetic action, plus the voltage due to the electrostatic action.

To obtain an idea also of what may be expected in case the power conductors are arranged in a vertical plane, other conditions being the same as before, Fig. 10, the foregoing calculations were applied with the results shown below:

$$\sqrt{40.5^2 + 17^2} = 43.923 \text{ feet}$$
$$\sqrt{39.5^2 + 17^2} = 43.003 \text{ feet}$$
$$\sqrt{40.5^2 + 10^2} = 41.716 \text{ feet}$$
$$\sqrt{39.5^2 + 10^2} = 40.706 \text{ feet}$$
$$\sqrt{30.5^2 + 3^2} = 40.608 \text{ feet}$$
$$\sqrt{39.5^2 + 3^2} = 39.615 \text{ feet}$$

Electromagnetic Induction.

logs

.00919, $\phi_{Am} = 1.17 \times 443{,}500 \times 100\sqrt{2} \times \log_{10}\frac{43.923}{43.003} = \sqrt{2} \times 51{,}850{,}000 \times .00919 = \sqrt{2} \times 476{,}500$ lines.

.01064, $\phi_{Bm} = 1.17 \times 443{,}500 \times 100\sqrt{2} \times \log_{10}\frac{41.716}{40.706} = \sqrt{2} \times 51{,}850{,}000 \times .01064 = \sqrt{2} \times 552{,}000$ lines.

.01076, $\phi_{Cm} = 1.17 \times 443{,}500 \times 100\sqrt{2} \times \log_{10}\frac{40.608}{39.615} = \sqrt{2} \times 51{,}850{,}000 \times .01076 = \sqrt{2} \times 558{,}000$ lines.

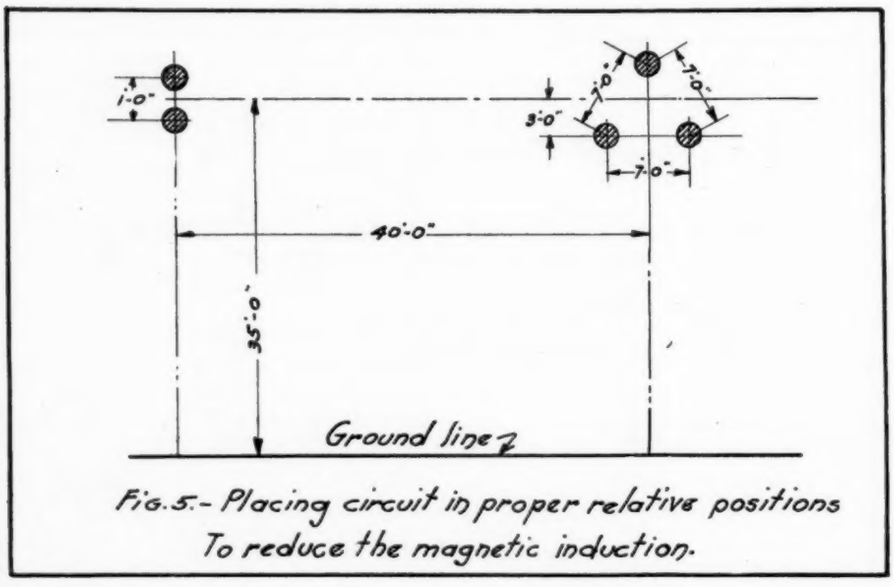


Fig. 5.- Placing circuit in proper relative positions To reduce the magnetic induction.

$$\phi = [476{,}500 \sin wt + 55{,}800 (\sin wt \cos 120° + \cos wt \sin 120°) + 55{,}200 (\sin wt \cos 120° - \cos wt \sin 120°)]\sqrt{2}$$
$$= [467{,}500 \sin wt - 279{,}000 \sin wt + 483{,}000 \cos wt - 276{,}000 \sin wt - 478{,}000 \cos wt]\sqrt{2}$$
$$= [-87{,}500 \sin wt + 5{,}000 \cos wt]\sqrt{2}$$
$$= -\sqrt{2} \times 80{,}600 \sin (wt + 86°44')$$
$$\frac{d\phi}{dt} = \sqrt{2} \times 87{,}600 \times 2\pi \times 60 \times \cos (wt + 86°44')$$
$$= \sqrt{2} \times 33{,}000{,}000 \text{ lines per sec. max.}$$
$$e_m = k\frac{d\phi}{dt} = -\frac{N}{10^8}\frac{d\phi}{dt} = -\frac{1}{10^8} \times$$
$$33{,}000{,}000\sqrt{2} = \sqrt{2} \times .330 \,/86°44'$$
volts, maximum cycle value.

Electrostatic Induction.

$$e_m = 25.75 \times .00706 \times 53{,}900 \times .00919 \times \sin (wt + 36°50') + 25.75 \times .00706 \times 53{,}900 \times .01064 \times \sin (wt + 156°50') + 25.75 \times .00706 \times 53{,}900 \times .01706 \times \sin (wt - 63°10')$$
$$= \left\{ \begin{array}{l} 72.0 \sin wt + 54.1 \cos wt \\ -95.8 \sin wt + 41.0 \cos wt \\ +46.7 \sin wt - 94.1 \cos wt \end{array} \right\}$$

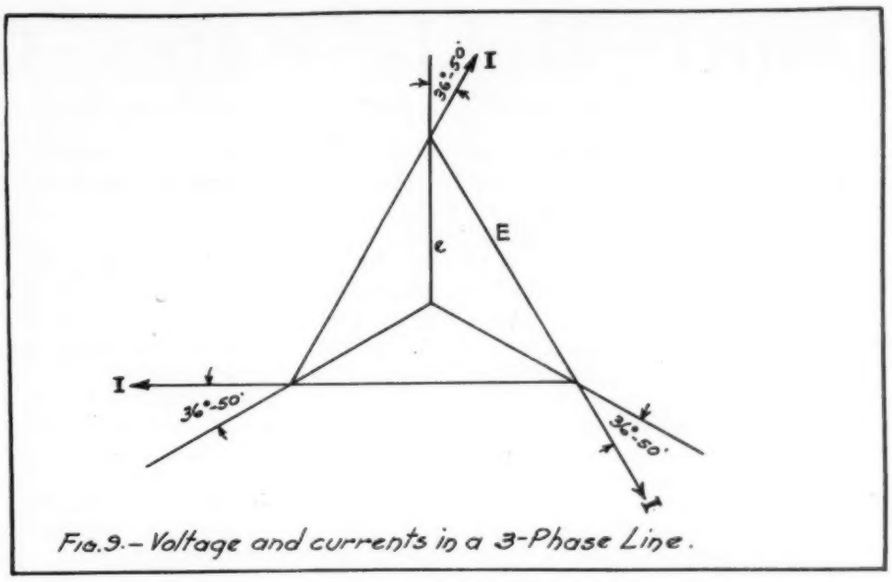


FIG. 9.—Voltage and currents in a 3-Phase Line.

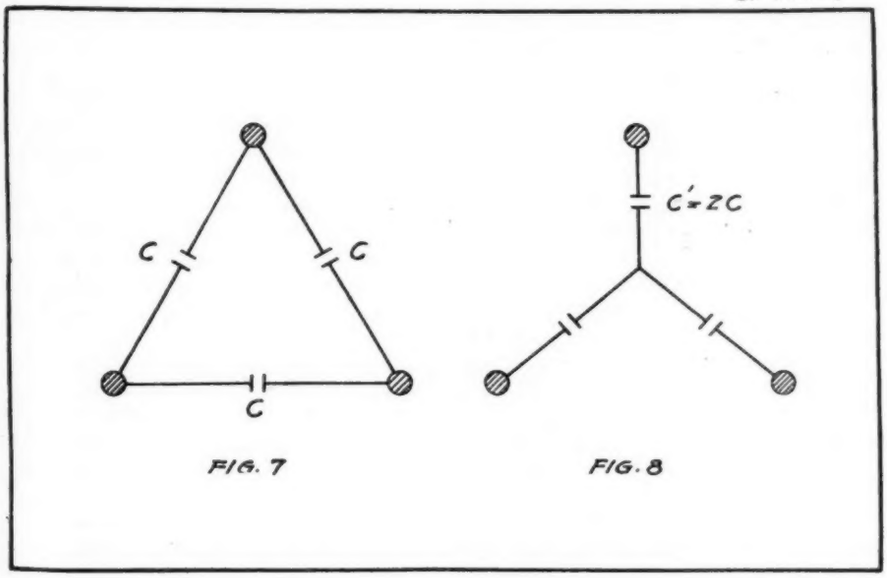


FIG. 7 FIG. 8

$$= 22.9 \sin wt + 1 \cos wt = 22.9 \sin (wt + 2°30') \text{ volts maximum cyclic value} = 22.9 \,/43°40'.$$

The actual result is the vector sum of the two effects, which is but little different from the latter. If any current is allowed to flow in the telephone circuit, these emf's are markedly reduced. This effect is too difficult to be treated satisfactorily in a short exposition.

Illinois Association Holds District Meeting in Galesburg.

About 50 telephone executives and 85 operators were present at the district meeting held by the Illinois Telephone Association in Galesburg, Ill., on May 13. Secretary J. G. Mitchell was in charge of the meetings for the telephone men, while Miss Pearl Thompson, traveling chief operator of the Illinois association, conducted the operators' schools of instruction.

After separate morning sessions for the telephone men and the operators, the entire assembly, including representatives of local civic organizations and the chamber of commerce, and city officials, enjoyed an excellent luncheon served in the Galesburg club dining rooms.

Addresses by Wilfred Arnold on the subject, "The Value of the Telephone in the Community," and by J. G. Mitchell on the subject, "The Builders," were features of the program on this occasion. Both stressed the extreme value of the telephone in the building of cities and communities and emphasized the important part it plays in everyday business and social life.

In the afternoon business sessions were again conducted for both the executives and the operators, and the meeting came to a successful close late in the day.

Cuban Telephone Co. to Vote on Increasing Stock to Six Million.

The Cuban Telephone Co. has called a special meeting of its stockholders in New York to vote upon a proposal to increase the capitalization of the company from $2,000,000 to $6,000,000.

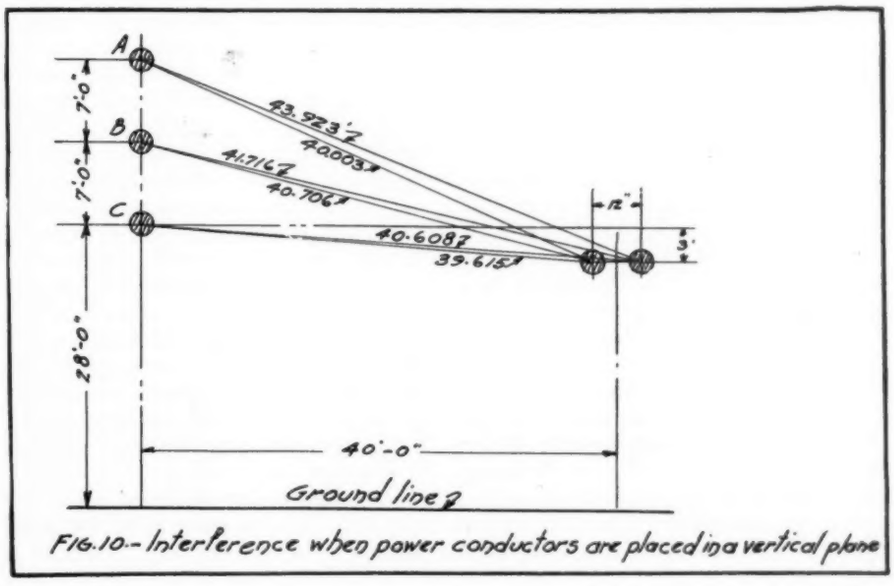


FIG. 10.—Interference when power conductors are placed in a vertical plane

Court Holds Rates Confiscatory

Injunction Against Order of Commission Fixing Rates of Indiana Bell Telephone Co. Made Permanent by Federal Court—Commission Rates Held Confiscatory—No Justification in Reducing Rate of Return to 6 Per Cent Says Judge

Upholding all but one of the contentions of the Indiana Bell Telephone Co., Judge G. T. Page, of Peoria, Ill., gave an opinion in the federal court in Indianapolis, Ind., on May 19, making permanent the injunction against the Indiana Public Service Commission's rate order of August 11, 1923.

After Judge Page concluded reading his opinion, the attention of attorneys was turned to the preparation of a formal order embodying the court's decree. It was expected that this would become the subject of conference among counsel later.

Effect of the Order.

The effect of the decision, according to counsel for the commission, will be to continue the interlocutory rates established by the federal court last August, until such time as the commission again opens the rate question.

Counsel for the company, while declaring they expected no difficulty in reaching an agreement on the formal order in the case, indicated that in their judgment the effect of the decision would be to let the company enforce all of its proposed rates of last year, if it sees fit to do so.

Edward M. White, deputy attorney general, who represented the commission, said that he did not believe the state would agree to any interpretation putting into effect the proposed rates of the company which are in excess of those established in the interlocutory decree. It is his opinion that any rates higher than those now operative can be put into effect only under order of the commission.

While the possibility of appeal from the decision was discussed informally it was indicated at the attorney general's office that the case would not be carried to the supreme court.

If the state decides to carry the case higher, the appeal will go directly to the supreme court of the United States. Some of the counsel for the commission expressed an informal opinion that an appeal could be based on the question of the 4½ per cent contract between the American Telephone & Telegraph Co. and the Indiana Bell.

Representatives of the company said they had no thought of an appeal. On their side the opinion was regarded as sustaining all of their contentions. Although Judge Page held with the state on the jurisdiction of the commission over rate of depreciation, he sustained the company's view that its allowance should be higher than the 4 per cent fixed in the contested rate order.

For the immediate future, and until a change is announced by the company and the commission, the interlocutory rates now in effect will continue. These rates, fixed when the temporary injunction was granted, have been in force since September 1, 1923, in Indianapolis, Shelbyville, Vincennes, Newcastle, Bluffton, Peru, Anderson, South Bend, Mishawaka, Hartford City, Kokomo, Muncie and Jeffersonville.

In all other cities, the rates announced by the commission last August are in force. The commission, in its contested order, made no increase in rates for Bloomington, Evansville, Huntington, Logansport, Muncie, Marion and New Albany, and the only one of this group affected by the court rates was Muncie.

According to computations made by the commission's experts, the order of August 11 would have added about $1,000,000 annually to the gross revenues of the company, and it is understood that the interlocutory rates mean a further increase of about $600,000. Application of all the company's rates proposed in the hearing before the commission would mean a still further increase of revenue of between $300,000 and $400,000 annually, it is said, or a total increase of $1,900,000 to $2,000,000 over rates in effect before the commission made its order.

The interlocutory rates in a few instances are as high as those stipulated by the company in its proposal to the commission, but in most cases are from 25 to 50 cents lower.

Major Findings of Judge Page.

Chief among the points in Judge Page's findings were these:

"1. The commission's rate base was too low, and 'the five-year period from 1916 to 1920 was a fair period in which to take the average costs for the purpose of arriving at a rate base value in the telephone business.'

2. If the plant life, as is agreed, is substantially 16 years, then the 4 per cent rate of depreciation is very substantially below the fair and reasonable rate of depreciation, and the reproduction cost figures, found upon the plaintiff's average cost price on a five-year basis from 1916 to 1920, are not subject to reduction because of the use of too high a rate for depreciation.

3. No proof was offered that the company's operating costs were excessive, and therefore, the commission was not warranted in reaching such a conclusion as a justification for its reduction of the rate of return to 6 per cent.

4. A substantial sum should have been added to the rate base value for going value.

5. No fraud or unfairness has been shown to exist in the license contract, the one by which the Indiana Bell is obligated to pay 4½ per cent of its gross revenue to its parent corporation, the A. T. & T., for rental of instruments, expert advice and other service.

6. The state commission has jurisdiction over the rate of depreciation in the absence of any action by the Interstate Commerce Commission fixing such rate."

Valuation submitted in the trial of the case before Judge Page ranged from $27,700,000, the figure presented by Edward W. Bemis, of Chicago, on behalf of the defense, to $43,400,000, the company's estimate. The commission's valuation, which caused the suit, was $31,955,000.

After discussing various valuations, submitted by Mr. Bemis, Earl L. Carter, chief engineer of the commission; O. C. Herdrich, a special accountant for the commission, who presented a book cost study; and B. G. Halstead, the company's appraisal engineer, the court continued:

"I have been much impressed by the fact that no witness in this case, other than those called on behalf of the plaintiff, has undertaken to make any analysis of the Halstead figures, and no one has made any direct attempt to contradict them.

Carter made his calculations on his 1913 to 1917 figures; that is, he started with the prices that were nine years old when the commission's investigation started, and ended with prices that were five years old when the investigation started."

In another part of his discussion of the factors affecting valuation, Judge Page said:

"The condition of plaintiff's property was a relevant and an essential fact, and, without a study of that condition, I am of opinion that no fair conclusion could be reached as to the value of the property.

Other relevant facts are contained in the record, viz: actual construction conditions under which plaintiff's property was developed; also, the cost prices paid by the plaintiff for material and labor. I am of opinion that those facts were essential and necessary in any attempt to arrive at a fair and reasonable rate base. All of those facts were open to the experts testifying on behalf of the defendants, and they made little or no study or use of them.

No one, on behalf of the commission, attempted to arrive at the reproduction cost, new, of the property."

Turning to rate of depreciation, the court said, in part:

"Inasmuch as the book account did not undertake to show anything more than net realized depreciation—that is, that part of the plant which had been removed, sold or abandoned, less salvage—it is quite evident that that figure of 3.43 per cent (the one obtained by Mr. Herdrich as the actual expense of the company), does not reflect the total depreciation, because it is within the common experience of everyone that property in use is not removed, sold or abandoned simply because it is some, or even much, depreciated. Ordinarily there is no removal, sale or abandonment until it becomes substantially unfit for efficient use.

That 3.43 per cent did not represent the true depreciated condition of the plant is evidenced by the fact that the plant was found by the commission to be in only 89 per cent condition, and the witness, Herdrich, took off 11 per cent additional, not found on the books, for the purpose of his computation. That alone would increase the average to more than additional 1 per cent for 10 years.

If the plant life, as is agreed, is substantially 16 years, then the 4 per cent rate of depreciation is very substantially below the fair and reasonable rate of depreciation, and the reproduction cost figures, found under the plaintiff's average cost price on a five-year basis from 1916 to 1920, are not subject to reduction because of the use of too high a rate for depreciation."

Confiscatory Rate of Return Defined.

Referring to the question of what may be construed as a confiscatory rate of return, the opinion says:

"In entering upon the business of a public utility, there is an undertaking on the part of the investors, who furnish the money necessary to establish the utility, to devote their property to the sole purpose of performing the public service in question, and there is an undertaking on the part of the government to require its people to pay a reasonable return for that service.

Leaving out of consideration the question of what may be in any given case, a fair return for the user to pay for a service, the fair return, generally speaking, is such an amount as would at the time of the inquiry induce the investment of money in such a utility.

Money will not be invested in utilities unless the probable return will be at least equal to the return on securities of like kind and character; otherwise, many communities would be left without necessary utilities until they could be established under public ownership.

One method of arriving at those conditions that would induce investment in public utilities is by testimony showing the rate that securities of like kind and character command in the market. Upon the hearing the commission used Mr. Bemis to furnish such evidence, and from his testimony the court would be justified in arriving at the conclusion that a fair and reasonable rate of return would be considerable in excess of 8 per cent on such investment.

Exhibit 32, made by Mr. Bemis, shows that in the last 10 years there has been invested by plaintiff nearly $24,000,000, and that over $18,000,000 has been invested since January 1, 1917. Under date of March 30, 1920, the commission authorized plaintiff to sell, at not less than 98 per cent of their face value, $11,000,000 of its three-year 7 per cent notes.

The commission thereby found that it was necessary and fair and reasonable to pay 7⅔ per cent to induce the entry of that money into the utility. It, at the same time, authorized the assumption by the company of more than $500,000 of first mortgage gold bonds, long outstanding against the South Bend Home Telephone Co.

First mortgage bonds, inasmuch as they may exhaust the whole property, invite investment at a lower rate of interest than unsecured notes, which, in their turn, may, as against the stockholder, exhaust the whole property; and preferred stock, in the form in which it is ordinarily issued, will invite investment at a lower rate than common stock. This conclusion is supported by all of the testimony in the case on the question of the relative value of securities.

Some authorities seem to hold that, although a rate may be lower than the facts in the case may possibly justify, yet it may not be confiscatory.

There may be conflict in evidence upon the question as to what will induce investment of money in utilities, and as to what is a fair and reasonable return thereon, but when all the evidence has had proper consideration and a rate of return arrived at, then unquestionably that rate of return should be allowed and any lower rate would be confiscatory."

Commenting on the amount to be allowed for going value, the opinion recited some of the details in the transfer of the Central Union Telephone Co.'s property to the Indiana Bell, and added that even though some amount for going value was included in the sale price, for which assumption no evidence was offered, the record in the present case shows that nearly $9,000,000 was expended on the property in 1920, 1921 and 1922.

"There is evidence to show that the expenditure of that money contributed to a higher state of efficiency in 1920, 1921, 1922 and 1923," the opinion continued. "I am of opinion that a substantial sum should have been added to a higher state of efficiency in 1920, called going value."

Judge Page declared that, in his opinion, a deficiency in revenue of $1,276,323 should be added to present rate bases. This amount results from an agreement of the commission, after the company's first suit two years ago in the federal court, to amortize over a five-year period the deficiency accumulating from 1922 through the collection of lower rates than those which would be allowed by the commission as a result of its state-wide inquiry.

"A failure to add to the capital will deprive it of any return on it after five years," the court said, "until a new base is made, and of any per cent that the final rate of return may exceed 6 per cent."

A. T. & T. License Contract.

Discussing the license contract with the A. T. & T., the opinion declares:

"The evidence before the court wholly fails to show that there was any fraud or bad faith in making the license contract. The commission did not undertake to so find, unless this negative finding was intended to reflect such a conclusion. The evidence does not indicate that the officers of the Indiana Bell have exercised a proper discretion in the matter, for the reason that they had no discretion to exercise. The American Telephone & Telegraph Co., which completely owns and controls the Indiana Bell, prepared the contract, submitted it to the officers of the Indiana Bell and they, as a matter of course, approved it.'

That statement seems to have had for its sole foundation the relation of the parties by reason of the ownership of licensees' stock by licensor. The supreme court said that the ownership of the stock was unimportant, except to invite careful scrutiny, and, of course, if the scrutiny developed nothing more than the ownership of the stock, it would be traveling in circles to draw any further inference therefrom. I am of opinion that no fraud or unfairness has been shown to exist in the license contract."

In the last pages of his opinion Judge Page presented two statements on estimated returns, one using the property value found by the commission, and the other using the plaintiff's five-year average cost base, 1916 to 1920.

He said that these statements seemed to him "to include additions that should fairly be made, and show the confiscatory character of the commission's order, without using at all many figures favorable to the plaintiff, sustained by much evidence in the record." Judge Page added that the statements were made solely for the purpose of illustration.

On the commission's valuation, after adding the total of the deficiency to be amortized, together with betterments from May 1 to July 31, 1923, and $415,359.95 for going value, the judge found a modified commission base of $33,994,222.61, on which a 6 per cent return would be $2,039,653.36, against which he found a net earning of only $1,607,162.07. Using the company's average value for 1916 to 1920 of $35,773,299.12, he found a net earning of $1,501,314.07, against a 6 per cent return of $2,199,786.93.

Telephone Business Correspondence

Company Representatives Can Contribute Much to a Utility's Success in Creating Good Will—Ninth and Concluding Instalment in a Series of Articles on Better Business Correspondence—How to Dictate to a Stenographer

By Frank E. Bohn,

Vice-President and General Manager, Home Telephone & Telegraph Co., Ft. Wayne, Ind.

Once one has mastered the art of business correspondence, it becomes a genuine pleasure to dictate letters. There is, however, a right way and a wrong way to dictate and, if one expects to get the most out of his stenographer's ability, it is well worth his while to acquire the right way. But, before discussing this subject, it might be well to review a few points which were brought out in previous installments and which have a direct bearing on the subject of this chapter.

The prime essential is a reasonable acquaintance with the mother tongue, a command of the essentials of good English. Correct grammar, spelling and punctuation are of vital importance. Good grammar may pass without comment and possibly without notice, but bad grammar will attract critical attention and too often create a most unfavorable impression. Improperly written and incorrectly punctuated letters with poorly constructed sentences and misspelled words are always subject to misinterpretation.

Mental alertness and an imaginative mind contribute to a live, interesting letter. The writer should imagine he is actually speaking to the person addressed. It is possible to talk by letter to a person, although he may be many miles away, in the same words that one would use if he were sitting beside one's desk.

A correspondent must know his subject. He should have a well-defined idea of just what the letter should contain. The facts should be gathered in advance of dictation. Put yourself in the reader's position. Endeavor to get his viewpoint and govern yourself accordingly. Be fair.

Think by paragraphs, paying particular attention to coherence so that the reader's mind may be led by logical progression from one idea to another.

Brevity is desirable as a rule—but not always. For instance, in answering complaints and questions, take pains to make the subscriber feel that he is receiving earnest and respectful consideration. However, avoid repetition and verbosity. Make words count. Be concise.

Strive to cultivate cordial public relations. Use courtesy and tact, as they are powerful aids, sometimes more potent than genius. Courtesy creates feelings of mutual respect and makes for satisfaction.

Do not write when angry or annoyed. Avoid irritability, injury, self-pity, impertinence and suspicion. A strong man will be forbearing when he has provocation to be otherwise. Be frank when circumstances call for it and firm when necessary, for frankness and firmness may be so controlled in expression as never to give the impression of rudeness or conceit.

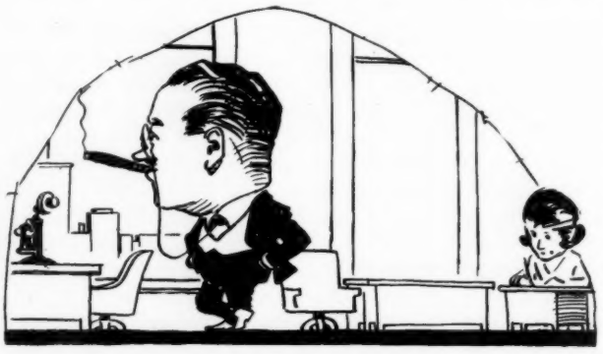
"It Becomes a Genuine Pleasure to Dictate Letters."

Remember a business letter today is regarded as the personal representative of the company. Therefore, put into your letters a spirit which makes them truly expressive of the policies of your company.

Start your letter with a paragraph that means something and end it likewise.

Avoid stereotyped, trite and hackneyed expressions throughout.

With these things in mind, start dictating to the stenographer by phrases, or word groups, enunciating distinctly. The following is an illustration:



"Watch the Stenographer's Pencil as You Dictate and Govern Yourself According to Its Speed."

"We are pleased . . . to acknowledge . . . your letter . . . of August 10th . . . inquiring about our preferred stock. (Paragraph)

"This stock . . . is sold at par . . . (parenthesis) fifty dollars per share (parenthesis) . . . plus accrued dividends . . . from July 1st . . . Dividends are payable semi-annually . . . on the first days of January and July . . . at the rate of seven per sent . . . per year . . . which is an attractive yield. . . . The dividends are cumulative . . . which means that . . . should the company . . . for some unforeseen . . . and quite improbable cause . . . fail to pay . . . its regular dividend . . . on this stock . . . it must . . . from its future earnings . . . pay any such dividends . . . remaining unpaid . . . as well as current dividends . . . before it may pay . . . a dividend on its common stock. (Paragraph)

"This stock . . . is not speculative . . . but is so safe . . . an investment . . . that it should be bought . . . for the purpose . . . of tucking it away . . . in your strong box. . . . There is a large equity . . . in the property . . . behind the stock . . . and it is difficult to conceive. . . of any contingency . . . happening . . . which might impair . . . the security . . . of the principal. (Paragraph)

"The proceeds . . . from the sale of this stock . . . will be used . . . to finance extensions . . . to the company's plant . . . made necessary . . . by the increased demand . . . for telephone service . . . in our rapidly . . . growing community. (Paragraph)

"A balance sheet . . . and earnings statement . . . are enclosed . . . for your inspection. . . . An examination of them . . . will prove . . . the reliability . . . of our claims. . . for the stock . . . as being . . . a most attractive investment . . . with good collateral value . . . backed by sound earning power . . . and facing a future . . . practically as certain . . . as the future . . . of this community itself. (Paragraph)

"We shall be glad . . . to receive your order . . . for any amount . . . either for cash . . . or on the installment plan . . . at five dollars per month . . . per share. . . . If . . . however . . . there is any other information . . . you desire . . . we shall be glad . . . to furnish it . . . upon request."

Watch the stenographer's pencil as you dictate and govern yourself according to its speed. At the beginning of each paragraph, say, "Paragraph" as you dictate. Spell out proper names and unusual words. In cases where you have a preference in punctuation, indicate it to the stenographer at the proper place as you dictate.

If you will follow this practice of dic-

tating by short word groups, or phrases, and enunciating distinctly, the stenographer should have little or no difficulty in following you. You will also find that this practice will aid you in thinking clearly.

Men in every line of business are beginning to realize the importance of giving more attention to their business correspondence. Much is being written for the guidance of the business correspondent, and yet we are a long way from having reached a state of efficiency in this art, and it is an art.

Fred Kelly in "Human Nature in Business," just recently had this to say:

"Nearly every business letter I receive confirms my belief that no branch of business is carried on so stupidly as ordinary correspondence."

What a fine thing it would be if those of us in the telephone business would set an example for others to follow! We have blazed the trail in many things. Why not in the art of letter writing?

Construction Planned and Under Way

Progress on This Year's Construction Program Reported by a Number of Companies—Programs and Budgets Just Made Public by Others—New Exchange Buildings to be Erected in Which New Equipment is to be Installed

News concerning construction activities in the Independent telephone field continues to come in to TELEPHONY. A number of companies report plans for the erection of new exchange buildings this year, in which new central office equipment is to be installed. Others report programs of considerable magnitude for inside and outside construction work, including the rebuilding of existing plant and extensions and additions to serve prospective subscribers.

The construction programs of a number of companies are well under way and some work has already been completed.

The directors of the West Texas Telephone Co., of Brownwood, Texas, at their annual meeting on May 5, approved a budget of $60,121 for extensions and reconstruction of plant during 1924. Of this amount $28,308 is estimated to cover reconstruction.

Of the total plant expenditures $30,928 are for construction and reconstruction at exchanges and the balance, $29,193, covers construction and reconstruction of toll lines. The latter includes the stringing of 70 miles of No. 12 N. B. S. gauge copper metallic circuit.

Of the total work planned for in this year's budget approximately $17,500 are for extensions at the company's Brownwood exchange and the balance, $13,428, is for the other exchanges in the West Texas system.

A total of 16 exchanges are operated by the West Texas Telephone Co., with 7,300 stations in operation. The company also operates 600 miles of toll pole line carrying 2,300 miles of toll wire, of which approximately 1,400 is copper. The officers of the company, as elected at the recent annual meeting, are as follows:

President, G. N. Harrison; vice-president and general manager, F. W. Greber; second vice-president, J. A. Walker, secretary-treasurer, J. F. McKee.

The Ware telephone lines in and about Omaha, Ark., have been purchased by Lorin W. Timmons, who has already commenced to rebuild the system.

The Eel River & Southern Telephone Co., of Ferndale, Calif., is to have a new home in the near future and when the building is completed a new switchboard will be installed. Contract for the building has been awarded and construction work will be begun immediately.

The Lee County Telephone Co., of Fort Myers, Fla., is to erect a new exchange building, which, when completed, will house new central office equipment, according to an announcement made by President G. M. Heitman.

The Commercial Telephone & Telegraph Co. has installed a new and modern switchboard in its Fairfield, Ill., exchange. The new board has a capacity of 1,000 lines.

The Washington Home Telephone Co., of Washington, Ill., is installing a new Stromberg-Carlson superservice switchboard in its new home in a building which the company purchased recently and remodeled at a cost of $15,000. The new central office equipment will cost approximately $30,000.

The Nevinville Telephone Co., of Nevinville, Iowa, of which Grant Carson is manager, has decided to erect a new exchange building and is already receiving bids for the contract.

Work of rebuilding the Guthrie Center, of Guthrie, Iowa, has been started, the old wires being taken down and cables put in. When the work is completed the greater part of the system will consist of cables. The estimated cost of the improvements is $2,500.

The Staley & Bricker Telephone Co. has purchased a site for the erection of a new exchange building in Yale, Mich., during the summer. According to the plans, the telephone exchange will occupy the first floor of the building, the second to be used as living quarters.

The following Minnesota companies contemplate spending considerable sums of money on repairs, replacements and new construction work:

Clear Valley Telephone Co., Clearwater; Edgerton Telephone Co., Edgerton; Freeborn Telephone Exchange, Freeborn; Hoffman Telephone Co., Hoffman; Hutchinson Telephone Co., Hutchinson; South Dakota Rural Telephone Co., Jasper; Lincoln County Telephone Co., Lake Benton; New Richland Telephone Co., New Richland; Sanborn Telephone Co., Sanborn; Electric Phone Co., Stewart, and Twin Valley-Ulen Telephone Co., Twin Valley.

The Holden Home Telephone Co., of Holden, Mo., will spend $6,000 for construction work during the ensuing year, according to a report from Manager M. L. Golladay. In addition to making repairs and replacements to its existing plant, the company contemplates doing considerable new construction work.

The Portsmouth Home Telephone Co., of Portsmouth, Ohio, expects to carry out an extensive construction program this year, according to Superintendent C. W. Kugelman. The program will involve the expenditure of about $100,000.

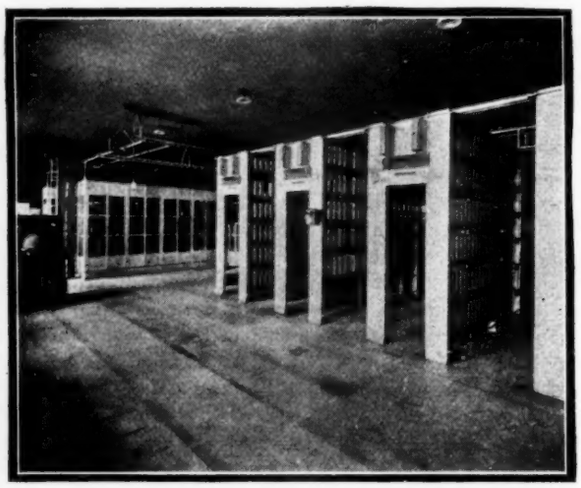
The installation of underground conduit and cables will constitute a large and important part of the work. In addition the switchboard at New Boston will be rebuilt and telephone lines will be extended to serve several communities not now served.

The telephone system at Weslaco, Texas, recently purchased by H. A. Davis, of Skiatook, Okla., from Gustave Schroeter, is to be entirely rebuilt. The new owner plans to erect a new home for the local exchange and to install new central office equipment, when the building is completed.

The Intermountain Telephone Co., of Bristol, Tenn.-Va., has completed the erection of a new two-story modern, fireproof exchange building. The building is of brick and reinforced concrete construction with steel window sash. The work of installing the new central office equipment is rapidly nearing completion, and it is expected that it will be in operation on June 1.

The Athens Home Telephone Co., of Athens, Texas, is to rebuild its entire plant this year, at a cost of $100,000, according to an announcement made by Manager E. M. Kimbrough. Work on the erection of a new and modern two-story

Strowger Automatic Operati



EXCHANGE OF YORK TEL. & TELEG. CO. AT YORK, PA.

The equipment in the 2900 line exchange shown above is kept in good order by one man assisted by two girls who take care of all routines and adjusting.

LIKE any other fine m an equipment require e a ing what little labo d n an automatic excha in

Records from scores of comp s o matic equipment show that int deal less than they were fo ei exchanges up to 3000 or 4 ine to lock the doors at 6 o'clo t switches to work unatten un morning.

Many companies report that ir accurate and reliable service h employes than recommended o

When an exchange is cut ov o men already in charge are ab o without any difficulty. Our at them and lays down simpl d followed.

Those contemplating new c al remember that Strowger Au ati maintenance costs.

Automatic Ele

FACTORY, AND G ER
1033 WEST VAN B N S

ASSOCIATE MPA
International Telephone Sales and Engineering Co n
International Automatic Telephone Company, Ltd
Automatic Telephone Mfg. Co., Ltd
Compagnie Francaise pour l'Exploitation des Proc oms
Automatic Telephones, Ltd

i[n] Lowers Maintenance Costs

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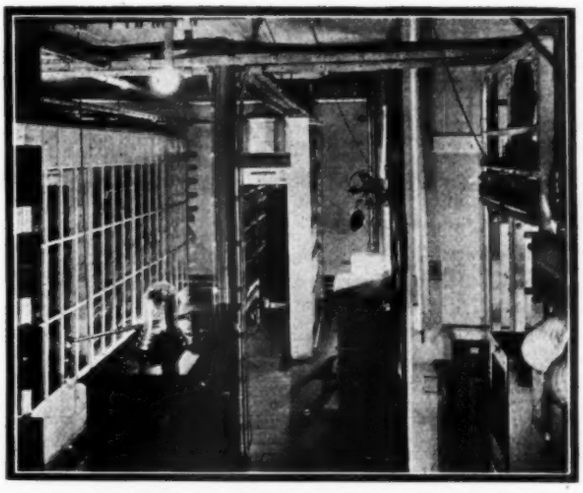

THE CAMBRIDGE, OHIO, EXCHANGE OWNED BY CAMBRIDGE HOME TEL. CO.

One man and one girl have no difficulty in caring for all inside maintenance work for the above exchange. In addition they take care of complaint reports and testing with the trouble men. There are 1800 lines in this office.

Strowger Automatic equipment has been adopted by the world's largest operating organizations as standard for installations in exchanges of all sizes.

le[c]tric Company

ND [G]ERAL OFFICES
AN B[u]N ST., CHICAGO

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Proc[es] omson-Houston ..... Paris
..... Sydney

exchange building has already been commenced. When completed new switchboard equipment will be installed.

The Lewis County Telephone Co., which succeeded the People's United Telephone System, of Weston, W. Va., has made extensive improvements and additions to the system. It has installed new switchboard equipment at Berlin and Jane Lew and expects to replace the present central office equipment at Hortner in the near future.

Since the first of the year about 400 new telephones have been installed, General Manager J. Roy Watson reports.

Annual Convention of Northeastern Indiana Association.

The Northeastern Indiana Telephone Association met in annual convention in Fort Wayne, Ind., May 20. The meeting was attended by 150 officials and operators representing more than 35 telephone companies in the northeastern section of Indiana and the northwestern section of Ohio.

The forenoon session was held jointly with the operators in the Fort Wayne Chamber of Commerce while an operators' get-together meeting convened in the afternoon in the assembly room of the Home Telephone & Telegraph Co.'s Main office.

P. J. Maloney, president of the association, called the meeting to order at 10:00 a. m. After a short business session E. C. Miller, president of the Fort Wayne Chamber, was introduced. In most cordial words Mr. Miller welcomed the convention to the city of Fort Wayne and in behalf of the Chamber of Commerce extended to the association a standing invitation to meet in Fort Wayne regularly, expressing the hope that the convention would be most successful and enjoyable.

"Standardization" was discussed at length by A. L. Staderman, telephone engineer and secretary of the Citizens Independent Telephone Co., Terre Haute, who emphasized the great need of standardizing telephone equipment and operating in order to economize in the operation of telephone plants and the furnishing of telephone service. He also told of the immense savings that could be made by all industries if standardization would be carried out universally.

Mr. Staderman is a member of the American Engineering Standards Committee, having been appointed by the United States Independent Telephone Association as its representative in that body, and is at present engaged in working out details of universal standards covering operating methods as well as equipment and materials used by the telephone industry.

Following Mr. Staderman, Miss Bertha Faut, toll chief operator of the Indiana Bell Telephone Co., Indianapolis, talked on "Telephone Operating Problems." Referring to toll operating, Miss Faut said in part:

"From a traffic viewpoint, and as chief operators and supervisory employes, we have one thought in mind—the giving of efficient toll service to the public. To me there is one essential to this success, namely, cooperation, for the giving of telephone service is a joint job, and big results can be attained only by better and truer cooperation. Every office, large and small, has its important and particular duty to perform."

Continuing, Miss Faut advised every operator to pay particular attention to the correct routing of toll messages and also to the accurate recording of toll calls by the recorder, since considerable loss of circuit time will be the result of errors and omissions in recording the details of the call.

In conclusion she called attention to the fact that by following the prescribed operating rules and practices the operator can serve the company best and at the same time give efficient telephone service to the public. Miss Faut's talk closed the forenoon session.

At the noonday luncheon meeting Henry A. Barnhart, president of the Indiana Telephone Association, delivered the principal address. He deplored the political unrest and denounced the sharp practices of political reformers in the stirring up of dissatisfaction and strife throughout the country, which can only be detrimental to the welfare of the nation.

Mr. Barnhart condemned the bloc method and the forming of opposing factions in the national government, declaring that men be elected to office whose aims would be to serve all the people and not any particular section or class or bloc. He advised the selection of honest, upright men for officials and voting for the best man, no matter what his political creed.

In our modern institutions of education and training the young men and women in crafts and domestic science, Mr. Barnhart sees a great help in enlightening the coming generation and educating them to be able to think before acting.

The afternoon session was opened with an address on telephone engineering and maintenance by H. E. Gray, general plant superintendent of the Home Telephone & Telegraph Co. of Fort Wayne. Mr. Gray has had considerable experience in telephone engineering and has charge of the reconstruction work of the Home Telephone & Telegraph Co., which has been in progress for the past three years.

He gave some figures and facts relating to the work which has already been accomplished in connection with the converting of the old overhead system of wires to one of underground cable and automatic telephone service.

B. C. Schweitzer, commercial agent of the Home Telephone & Telegraph Co., followed Mr. Gray with a very interesting talk on commercial problems. In his talk Mr. Schweitzer covered very completely the order routine followed by the "Home" company which is, however, also adaptable to companies of smaller size. The discussion following Mr. Schweitzer's talk proved that the subject was of great interest to the meeting.

The result of the election of officers was the re-election of P. J. Maloney, of Columbia City, secretary of the Whitley County Telephone Co., as president; George John, general manager of the Indiana Bell Telephone Co., Huntington, vice-president; and Martin Umbach, toll commercial superintendent of the Home Telephone & Telegraph Co., Fort Wayne, secretary-treasurer.

Shortly before adjournment, Max F. Hosea, treasurer of the Indiana Telephone Association, made a short talk in which he discussed association matters. He directed particular attention to the mid-summer meeting of the Northern Indiana Telephone Association which will be held at Lake Wawasee, June 24, 25 and 26, urging all to attend this meeting and frolic and to make their hotel reservations in time.

After adjournment, by invitation of H. E. Gray, those of the convention visitors who wished were taken upon a tour of inspection through the city to view the work of installing underground conduit which is now in course of construction in connection with the vast program of reconstruction work which is under way and also to get an idea of the vast territory covered by the city.

The afternoon meeting of the operators was presided over by J. L. Lawse, district traffic superintendent of the Indiana Bell Telephone Co., Indianapolis.

Miss Margaret J. Norris, chief operator of the Laporte Telephone Co., Laporte, explained the new book of instructions issued by the United States Independent Telephone Association and its use.

Miss Louise Pohlmeyer, chief operator of the Home Telephone & Telegraph Co., gave a talk advocating right living in order to succeed in one's work.

Washington Association to Hold Convention in Puyallup.

The Independent Telephone Association of Washington has decided to hold its annual convention on Wednesday and Thursday, June 18 and 19, at Puyallup, Wash., according to an announcement made by J. W. Baker, of Spokane, secretary-treasurer.

Prices in the Metal Markets.

New York, May 26.—Copper—Quiet; electrolytic, spot and futures, 12¾c. Tin—Firm; spot and futures, 41c. Iron—Quiet; No. 1 northern, $20.50@21.50; No. 2 northern, $20@21; No. 2 southern, $20. Lead—Easy; spot, 6.87@7c. Zinc—Quiet; East St. Louis, spot and near-by, 5.65c. Antimony—Spot, 8.60c.

What Is Your Company Doing?

Chats About Company Doings

By Stanley R. Edwards.

"Well, I see your Independent friends have not really awakened to their own interests, which I presume is that of paying dividends," writes a former telephone man who is now living in the Southwest. "I have been quite close in Bell councils and also have familiarized myself with the Independent interests. I want to give you, for your personal consideration, the consensus of my investigations.

"I have investigated several companies working under agreements with the Bell company and all but five of them entertained a notion that the more they could hamper the Bell, with a view to their own gain, the more highly satisfactory was their performance.

When operating over Bell toll circuits, they attempt to use operating rules and symbols different from the Bell, claiming Independent standards are the best. Delays result and a great many complaints and rebates accumulate in which the Bell refuse to share. Consequently, the Bell company ties them up with a seemingly one-sided contract, as they see necessary.

Primarily, the Bell does not give a whoop to own these little outlying exchanges, and I have known of overtures of Independent owners being made to sell at a sacrifice, and turned down by the Bell. I have known the Bell also to lend money for rebuilding, not to gain control but to get the service up to where it would be even passable. Of course, they supervise the operation of the plant until they get their money out and do all they can to get the owner to see that harmonious operation will net him a profit.

These things I know in spite of all the cries to the contrary. I also know that "B," who built this plant and who has several neighboring exchanges and has always paid a dividend, is entirely Independent as far as ownership goes—hasn't even a written working agreement with the Bell. He also has been censured by the state Independent organization, of which he is a member, for working so closely to the Bell standards.

It is strange to me that they cannot get a lesson from his experience. He buys what and where he pleases; advice and assistance that he cannot otherwise obtain without cost except for actual service, he secures by careful and friendly co-operative service.

And he is even authorized to do the checking for several outlying Bell exchanges which come through here for long distance service. There has been no argument over a settlement in years and his rebates and lost calls are always at a minimum and allowed without protest.

Four other exchanges I knew of years ago, in the heart of the Independent section, were operated in the same way by one part owner and manager. He left the Bell and went into the Independent field because he thought he could make more for himself. He did, but was always at war with the Independents.

He refused to accept the Bell agreements generally used at the time and never signed any. He made his exchanges pay and the Bell never took them over. After some 12 years he went back to the Bell company and is now high in their

Remarkable Blind Telephone Operator.

councils. But he was then, and is now, working for his own monetary interests.

The exchanges went on for a few years as Independent and finally were taken over by the Bell to prevent their going out of business entirely. I know this, for I was in on the survey at the time.

Long before physical connection became a law, this man had physical connection with the Bell lines, for the simple reason that he accepted their engineers' views as to the equipment required to make the service acceptable and profitable.

He attended the Independent conventions and used his influence to impress on them the best way to make their service pay, which is their primary endeavor, or should be, but finally gave it up and attended strictly to his own interests. He never signed an agreement with the Bell company and never worked more to their interest.

About physical connection, I want to say this: At the time the matter came up I was in a position to know and have made many surveys of Independent plants with engineers where physical connection was asked and where it was desirable to the Bell company. That was the purpose of our investigations. It did not require a wide knowledge of telephony to determine that such service could not be made acceptable to the public with the Independent equipment used at that time. Later the equipment was brought up to standard.

The Western Electric has and does try to introduce its equipment in every field. They have tried it here, but accept "B's" statement that he has considerable money invested in Kellogg instruments and parts and to change would mean carrying additional repair parts.

The whole underlying fundamental is to make money. The Bell company knows, and every Independent company should know, that this can be done only by rendering unquestionable service. Unquestionable service cannot be rendered with two sets of operating rules. The Independent code may be all right, but it is not universally used. Where endeavors are made to amalgamate it with the Bell rules, confusion results. I have seen requests to incorporate certain changes in codes, etc. They may be an improvement, but they cannot be introduced successfully into long distance work through small Independent exchanges.

Another point worth consideration is that if the service is kept up to a high standard, the use of state and federal supervisors and commissions would soon die out entirely.

I presume I have taken too much of your time. I am not partial to either Bell or Independent at this time but see matters through an unbiased lens, so to speak. I am certain that the Independents could do a great deal more for themselves by doing less shouting and considering actual unchangeable conditions that affect their dividends.

I want to add this, however. I asked a Bell man why exceptions were made as to operating contracts; why some Independent companies were not required to sign them?

He replied, in substance: 'We would be glad to get rid of all the contracts but it is impossible to hold a majority of these managers to a settlement without them. Where we find a company which will meet us halfway, the contract is ignored and forgotten.'"

Handling one telephone with success is usually all that the average person is able to accomplish, but William Neer, blind telephone operator of South Solon, Ohio, handles 100 telephones with more ease and success than many operators with two good eyes.

When young Neer, who is just 21 years of age, was 6 years old, he was struck in one eye with a stone. Medical science then failed to save the sight, and infec-

tion later lost to the youth the other eye.

He was unable to find work that was fitted to his ability until persuaded to attempt the operation of a telephone switchboard He mastered the board in three hours and when the telephone executives heard of his remarkable ability, they made him the chief operator of the switchboard in his home town.

Young Neer knows every one of the 100 calls by sound and his long, slender fingers manipulate the cords, plugs and keys of the switchboard with lightning-like rapidity and with unerring accuracy. When a call comes in, the shutter drops and before it appears possible, the tips of the blind youth's fingers have found the right place on the switchboard and the parties are connected.

He is familiar with each separate telephone in the exchange and knows every section of the Kellogg switchboard so well that there is no delay in the calls. During his five years as operator, he has mastered by consistent hard work, the local as well as the long distance operating and is able to handle both at the same time with ease.

He has been perfectly satisfied with his lot since he found something to do to keep his hands and mind busy. He is an accomplished musician and owns an orchestra, of which he is leader and pianist.

Mr. Neer is giving such satisfaction in his telephone work that it is held probable he will continue for many years to form the living link between the telephones of his home town and the outside world.

Strong Program for Wisconsin Convention Next Week.

A strong and attractive program has been arranged for the 15th annual convention of the Wisconsin State Telephone Association. Questions that are foremost in the minds of Wisconsin's telephone men will be discussed by men thoroughly versed in their subject.

The convention will be held in Madison beginning Wednesday, June 4, and closing on Friday, June 6. The meetings will be held in Madison's fine new hostelry, the Loraine Hotel. Coming at the time it does, many of the telephone men will undoubtedly take advantage of Wisconsin's fine roads to motor to Madison.

The program in full is as follows:

WEDNESDAY, 9:30 A. M., JUNE 4.

Community singing and awarding of prizes. Contest open to all telephone companies which have representatives duly registered.

Convention called to order by the president.

Formal greetings of Madison business and professional men with responses.

President's Annual Address, by H. A. Price, manager, Markesan Telephone Co.

Appointment of Convention Committees.

"The Legal Aspect of the Orders and Decisions of State Commissions," by William J. Anderson, editor, Anderson's Madison Service, Inc.

"Commission Requirements Respecting Depreciation," by Guy T. Ellis of the staff, Railroad Commission of Wisconsin.

Report of Committee on Insurance, by W. L. Smith, manager, Badger State Telephone & Telegraph Co., Neillsville.

WEDNESDAY AFTERNOON, 2:00 P. M.

Business Session:

Reports of Officers.
Reports of Committees.
Election of Directors.
Discussions.

At this session it is the purpose of the directors to take up for discussion the report of the committee on insurance, the outline of the secretary for the work of the year, the budget of the association and any other matters which may be deemed necessary to promote the interests of the companies. Active participation in these discussions by all companies is earnestly solicited.

THURSDAY, 10:00 A. M., JUNE 5.

"First Aid," by F. R. Davis, president, First Aid Specialty Co., New York.

"The Importance of Safeguarding Business Records," by E. C. Smith, record protection counsellor, Madison.

"Organization of Women Employes for the Study of the Public Utility Business," by Miss E. M. Westenhaver, Beloit, chairman, Women's Public Utility Information Committee of Wisconsin.

"The Development of Radio and its relations to the Telephone," by W. D. Schulte, Madison, secretary, Burgess Battery Co.

THURSDAY, 2:00 P. M.

"Public Relations and Morale at Small Exchanges," by Harry E. Eldridge, Chicago, division commercial superintendent, Illinois Bell Telephone Co.

"The How, Why and When of Public Relations," by W. S. Vivian, Chicago, director of public relations, Middle West Utilities Co.

"The National Association," by F. B. MacKinnon, president, United States Independent Telephone Association.

THURSDAY, 6:30 P. M.

Annual Banquet.

Toastmaster, Major Edward A. Fitzpatrick.

Speaker of the Evening, Lewis E. Gettle, chairman, Railroad Commission of Wisconsin.

Music: Ray-O-Lite Chorus, French Battery & Carbon Co.

FRIDAY, 10:00 A. M., JUNE 6.

"Experiments with Wave Filters," by John N. Cadby, Madison, secretary, Wisconsin Public Utilities Association.

The electrical fellowship of the utilities association has been conducting a series of tests in connection with inductive interference and Mr. Cadby has consented to give the telephone men an outline of the work so far accomplished.

Short Talks on Subjects Related to the Industry by:

J. E. Carroll, Mauston.
W. F. Pinnow, Chilton.
S. N. Pedrick, Ripon.
C. B. Blackwood, Elkhorn.
E. B. Smart, Wisconsin Rapids.

"The Speakers Bureau," by Franz Herwig, director, Wisconsin Public Utilities Bureau.

FRIDAY, 1:30 P. M.

Business Session.

Unfinished business.
New business.
Adjournment.

On Friday afternoon at the close of the business session, arrangements have been made to have the delegates visit some of the points of interest in Madison. Transportation will be provided for those who desire to see the battery plants of the Burgess Battery Co. and the French Battery & Carbon Co., the University of Wisconsin, the Forest Product Laboratory, the Agricultural Experiment Station, Madison's parks and golf grounds.

England to America Telephone Service Probable.

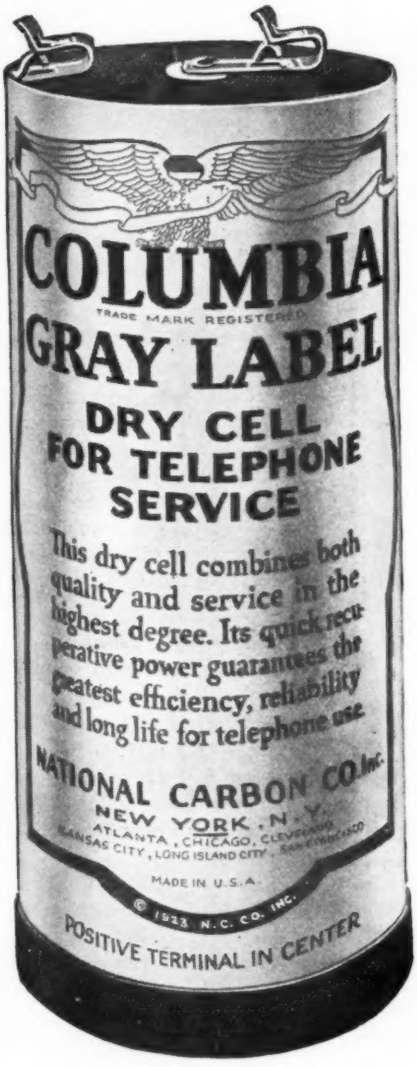
If the recommendations of the British Post Office to establish a wireless sending station for radio telephone communication with the United States are carried out, it will mean that telephone subscribers in the United States may talk to telephone subscribers in England over their home telephones, it was announced May 24 by the American Telephone & Telegraph Co.

A man in San Francisco may talk to a man in Glasgow, if the transoceanic system is installed, and probably will later be able to talk to a friend in Prague, Copenhagen or elsewhere on the Continent.

The year's experiments in wireless telephoning have shown that talking across the ocean is feasible most of the hours of the day in winter. Most of the time in summer the voices are drowned by the screaming of static, but it may be possible, with good luck, to get conversations through for a few hours each day during the summer.

Scientists and engineers are working on both sides of the ocean on the problem of overcoming static, but static has stubbornly resisted all attempts to solve it. Another difficulty that has to be taken into account in planning the transatlantic telephone is that of interference by ships or radio stations using a wave length close to the wave length used for telephoning.

Any ship on the ocean or any broadcasting station in Europe that used an interfering wave length might put a stop to radio conversation across the Atlantic. This has to be worked out by international agreement before it is attempted to install a costly service.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TRADE MARK REGISTERED
GRAY LABEL
DRY CELL
FOR TELEPHONE
SERVICE
This dry cell combines both quality and service in the highest degree. Its quick recuperative power guarantees the greatest efficiency, reliability and long life for telephone use.
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NEW YORK, N. Y.
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KANSAS CITY, LONG ISLAND CITY, SAN FRANCISCO
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POSITIVE TERMINAL IN CENTER

"HOW doth the busy battery improve each idle hour?" Ask that question every time you buy telephone cells, for upon the answer depends battery economy and the satisfaction of the service.

Columbia Gray Label Batteries improve themselves in their spare time, recuperating their strength. And if the idleness is prolonged, it's all the same to them. They don't swell with anger at being shelved, nor bite their backs through nervousness. Quiet and efficient, they work or rest for months and months—they cost less per month of service. Fahnestock Spring Clip Binding Posts at no extra cost to you.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC.
New York San Francisco

Canadian National Carbon Co., Limited, Toronto, Ontario

Columbia Telephone Batteries

"less cost per month of service"

THE LIGHT THAT DID NOT FAIL.

By Miss Anne Barnes,

Traveling Chief Operator, Iowa Independent Telephone Association, Des Moines, Iowa

One wild, wintry night, not so many months ago, I stood at a window of the telephone office in X, trying to muster courage to step outside and be battered by wind and snow as were the passing pedestrians. Although home, with comfort and warmth, was only a few blocks away, I stood irresolute as the snow slapped tauntingly against the windows on all sides of the building, and the wind diabolically moaned a story of cold and suffering beyond the doorstep.

While I stood looking out, I noticed a lighted lantern swinging over a point at the intersection of two streets. The wind seemed to be trying to whip out the light; the snow was plastered against the globe in great slabs, but that old rusty lantern, beaten by the elements, continued to send its message out into the night. As I saw autoists and pedestrians lurching forward with only one thought in mind—their destination—I reflected, "What if that old lantern's light should fail, tonight?"

And then, as if by some coincidence, I became conscious of the rising hum of operators' voices beyond in the operating room. Ordinarily, I could not hear their voices from the restroom. I thought, "Central and the old lantern are giving emergency service tonight."

The old lantern had hung there in fair and foul weather, until its message had come to be accepted almost unconsciously. What might happen if its light should fail?

The telephone operator had sat at her post of duty in fair and foul weather until her service had come to be accepted almost unconsciously. What might happen if her service should fail?

But I knew it would not fail, for history had proved that although she might be driven, like the old lantern, to her utmost capacity, her *service would not fail.*

With this sense of certainty, I went out into the night.

The statement of the telephone company says:

"Following a demonstration in January, 1923, made by the officials of the American Telephone & Telegraph Co. and the Radio Corp. of America, in cooperation, in which radio telephone speech was transmitted for two hours from New York to London, the British Post Office appointed a committee to investigate transatlantic telephony. This committee has recently recommended that the British Post Office establish a 200 Kw. radio telephone plant at their new radio station at Rugby, England.

The committee recommends that this plant be of a type similar to that which has been used by the American Telephone & Telegraph Co. and the Radio Corp. of America in the experiments which they have been carrying on for the last 18 months in transmitting speech across the Atlantic.

If this work is carried out, it is the expectation that under favorable atmospheric conditions during the winter months, it will be possible to connect telephone subscribers in the United States to telephone subscribers in London, and in this way permit them to talk to each other as they do over ordinary telephone circuits. In doing this the subscribers at each end would be connected to their respective radio stations by the wire telephone lines.

Atmospheric conditions, however, vary tremendously from winter to summer and during the different hours of each day. To determine the effect of such atmospheric changes, the engineers of the American Telephone & Telegraph Co., in cooperation with the Radio Corp., have been transmitting speech weekly from America to England, and have been measuring static interference and the strength of signals received from a number of British telegraph stations.

The British Post Office, to cooperate in this work, erected a special form of receiving antenna and, pending the erection of a telephone transmitting station, have been carrying out careful measurements of the energy which they receive under various conditions from the telephone transmitting station in America, and also from certain telegraph stations.

The tests which will be possible when the British transmitting station is completed will form another important step in the work which has been carried on for many years in the development of radio telephony across the Atlantic Ocean.

The tests which have already been carried out and the additional tests which will be made if the new British station is erected, will give information as to the practicability of establishing transatlantic telephone service, the best operating methods to be employed, the attitude of the public toward such a service, and many other factors necessary to be determined before the opening of any regular commercial service could be undertaken.

The difficulties of the technical problems to be overcome are well indicated by the fact that atmospheric conditions often change so greatly that the amount of power required at one time to give audible speech in England may be 10,000 times as great as that required a few hours before.

Briefly, the news from London indicates that preparations are well under way for transmission from London to New York, and that when completed two-way talking, at least experimentally, will be possible. It will be remembered that transmission from New York to London was successfully accomplished in January, 1923, the answers from London being telegraphed by cable."

Number of Telephones Greatly Increased Between 1917 and 1922.

The number of telephones in use in the United States increased from 11,716,520 on December 31, 1917, to 14,347,395 on the same date in 1922.

Statistics made public May 19 by the Department of Commerce also disclosed the rate of increase was 22.4 per cent, while the population was increased at a rate of about 7 per cent.

Nearly every state in the Union, the statement said, recorded substantial increases in the number of telephones in operation. The greatest sectional gains were reported from New England and the middle Atlantic states, which comprise New York, New Jersey and Pennsylvania, their combined increase for the five-year period being at the rate of 34.6 per cent, compared with 17.6 per cent for the remainder of the country.

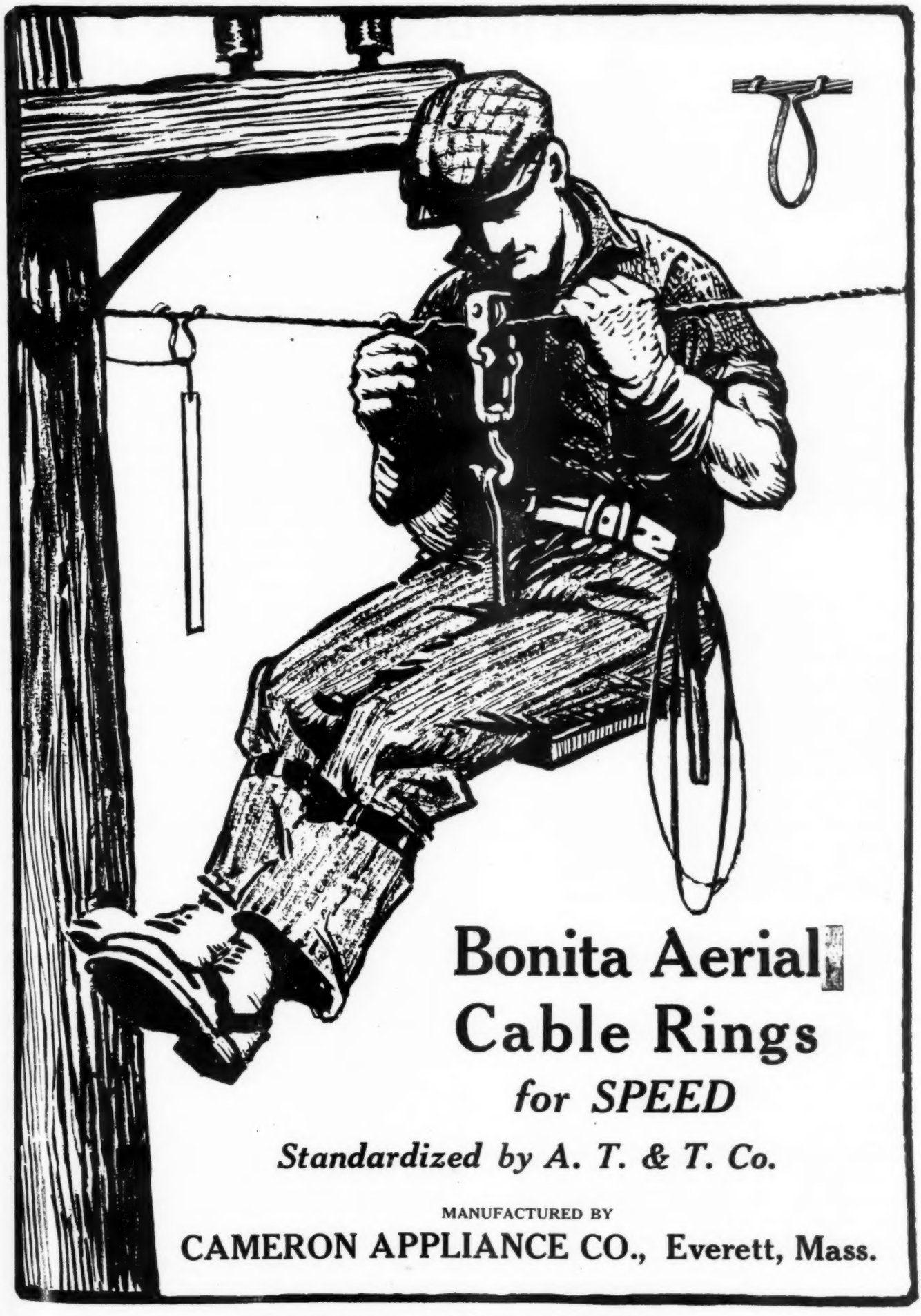
Florida, with 62.5 per cent, established the highest rate of increase for a single state, and New Jersey was second with 50.7 per cent.

Northern Indiana Association to Hold Three-Day Meeting.

A three-day convention and operators' school will be held by the Northern Indiana Telephone Association at Lake Wawasee, Ind., on Tuesday, Wednesday and Thursday, June 24, 25 and 26.

Vermont Association to Meet in Fairlee, Vt., June 20 and 21.

The Vermont Telephone Association will hold its annual convention at Lake Morey Inn, Fairlee, Vt., on Friday and Saturday, June 20 and 21.



Bonita Aerial Cable Rings

for SPEED

Standardized by A. T. & T. Co.

MANUFACTURED BY

CAMERON APPLIANCE CO., Everett, Mass.

Please tell the Advertiser you saw his Advertisement in TELEPHONY.

Proper Maintenance of Cable Plant

The increased use of cable in place of open wire has made it necessary that wire chiefs and exchange linemen learn enough of cable work to enable them to locate and clear cable trouble and perform such periodical inspections as are necessary to prevent cable failures.

Trouble Avoided by Systematic Inspection

A study of the causes of cable failures reveals that almost 90 per cent of these failures can be avoided by a system of inspection. Such an inspection reveals the causes and enables us to repair them before the service has been interrupted.

The causes of preventable cable trouble may be divided into two general classes: First, breaks in the sheath which result from unnecessary strains and chafing; second, burns from electrical sources, such as crosses with power wires, lightning, or electrolysis.

The frequency of inspections depends upon the age of the plant. New aerial plant should be inspected once each year. In older plants a semi-yearly inspection is advisable. The man selected to make the inspection should be provided with a hammer, screwdriver, cable car, terminal wrenches and pliers and should carry friction tape for temporarily covering sheath breaks. He should also carry marlin or copper tie wire, pipe straps and screws for fastening them on the poles. He should also be provided with a notebook in which a record of all faults located or repaired should be recorded.

Such conditions as he is unable to repair permanently can be taken care of later and a general summary of the results of the inspection can be made. The inspector should watch for the following conditions and defects:

Where the cable leaves the underground, the riser pipe should be securely fastened to the pole and the top of the pipe should be protected with a pipe cap to prevent rain or snow filling the pipe and causing the cable to be crushed by ice during cold weather; the riser cable should be securely clamped to the pole and a careful inspection for cracks, spur holes and other cuts, which might have been caused by men working on the pole.

When underground protection boxes are used, they should be inspected carefully to see that the doors fit tightly, that the top has not opened up, and that the potheads are properly filled and supported.

Where the cable turns from the pole to the messenger, it should be carefully inspected at the top clamp and, if the sheath is bent over the clamp or is being cut into by the clamp, the clamp should be removed to relieve the strain and the injured armor reinforced with solder to prevent cracking open.

(Continued from page 15.)

In the spans between the poles the cable rings or marlin supports should be watched and any that are off or out of place should be replaced, as cracks and crystallization soon develop where the cable is not properly supported.

All splices should be carefully inspected at either end for signs of cracks at the ends of the joints, and where the marlin ties which support the splice are rotted, they should be replaced with new marlin or with ties of No. 16 gauge tinned annealed copper wire, which has been found to be more permanent for aerial cable construction than marlin.

At each pole the cable should be carefully inspected for cracks, cuts and worn places where the cable might have rubbed against the pole or its attachments. If the cable is pulled tightly against the outside of a corner, steps should be taken to pull back slack, or, if slack is not available, a short piece of cable should be cut in, for a condition of this kind is sure to develop trouble.

Branch splices from the main cable should be carefully inspected. The cross messenger should be on the same grade as the main messenger and securely clamped to it. Where this has not been done in the original construction, trouble always follows, and it has been found necessary to change the cross messenger to prevent its recurrence. Branch cables should be securely tied at the Y end of the splices, and the splices supported to the messenger with marlin or copper tie wire.

Small distributing cable terminals are one of the biggest sources of cable trouble. This is due to the fact that workmen often use the cable loop to assist themselves when climbing the pole. It is also due to the main cable moving and placing a strain on the cleats that hold the cable terminal to the pole. Where there is evidence of the terminal shanks pulling on the cleats, they should be removed, the cable carefully inspected for cracks; if found to be good, it should be reclamped to the pole so as to remove the tension of the clamps. Terminal covers should be repainted at the first signs of rust.

Where protected aerial terminals are used, the inspector should make sure that all protection blocks are in place, and that the springs which hold the blocks have sufficient tension to insure good contact with the ground plate. The ground wire should be securely fastened to the ground plates in the protector, and fastened securely to the pole and ground rod. Before leaving the terminal the inspector should remove all dead drops from the terminal and see that the ends are tied neatly back onto the drops.

Special attention should be given to the clearance of power wires both from the cable and drops. It is advisable to maintain a clearance of not less than 40 inches between the electric light wires of less than 5,000 volts and the telephone plant. Where cables cross above trolley wires at a height of less than 28 feet, cables and messenger should be protected with trolley guards.

The keeping of cables clear of trees is absolutely necessary. Cable that has been placed through trees without clearance soon develops trouble. The sheath is soon weakened where branches rub against it and cracks open up and, where pure lead sheath is employed, crystallization develops to such a point as to make the cable absolutely worthless. Where it is possible to trim the trees, this should be done. Use of tree moulding is advisable only where the branches are small. Where the interfering branches are large, it is advisable to rearrange the cable on the poles or cut the cable below the branches. Where moulding is used to secure protection from large branches, cracks soon develop in the cable at the end of the moulding.

Where cables are run on steep grades caution should be taken to prevent the cable from sliding down hill. This will first be noted by slack at the poles near the bottom of the hill, and cracks will soon develop in the sheath at the top of the grade. This can be overcome by placing grade clamps between the cable and messenger and head guying the poles.

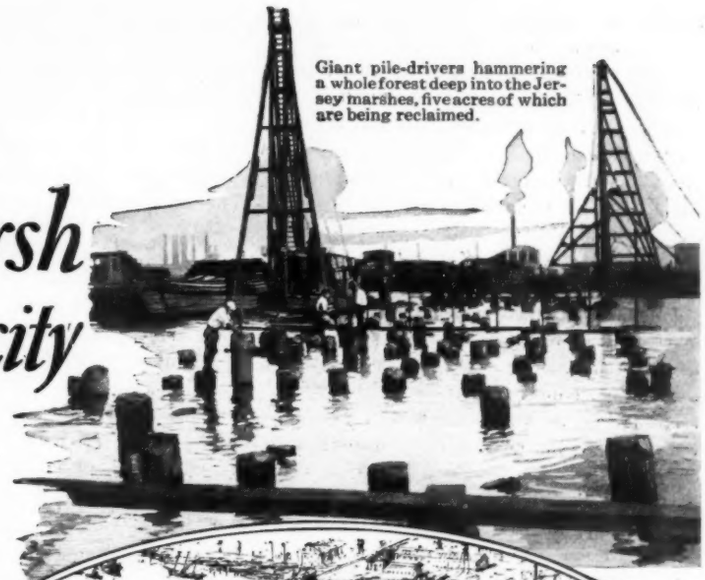
The presence of unnecessary slack in the messenger strand is a forerunner of trouble. This will usually develop crystallization at the poles on account of the span swinging unevenly. The slack is caused by the anchor giving away or the strand cutting into the poles at the dead ends, where the poles have not been protected by metal shims.

If the anchors are at fault, they should be reset. Where the strand has cut into the poles, the poles should be protected with metal shims before the messenger is pulled taut. Any excessive slack in the cables should be cut out.

During the last five years, experiments have been conducted aiming to prolong the life of pure lead cables that have become crystallized. This has been accomplished by painting the sheath with an elastic asphalt paint, and has resulted in a big reduction of trouble during wet weather. The paint should be applied only after a long dry spell, as it is not advisable to attempt to seal the cable up during damp weather.

Underground cable does not require the frequent inspection that aerial cable does, for it is not subjected to the severe strains that come to aerial cable. Inspection of this class of plant once in two years will

How your voice is turning a marsh into an industrial city



Giant pile-drivers hammering a whole forest deep into the Jersey marshes, five acres of which are being reclaimed.

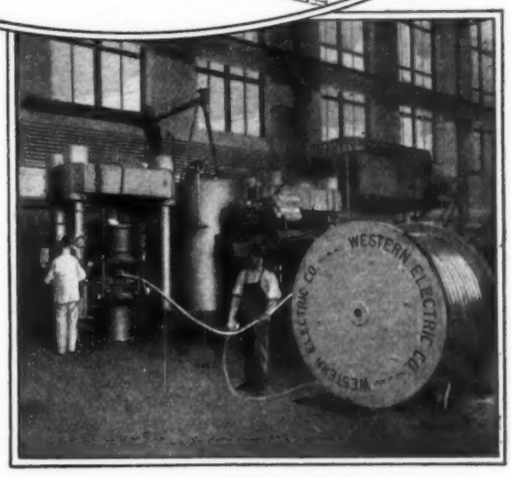
YESTERDAY a marsh, today a center of building activity, tomorrow the second largest telephone factory in the world*—such is the change which Western Electric is bringing about in New Jersey's great industrial area between Newark and Jersey City.

Springing into being at the call of your voice! So that you can talk near and far, your needs for more and more telephones and cable and equipment have given rise to this great expansion.

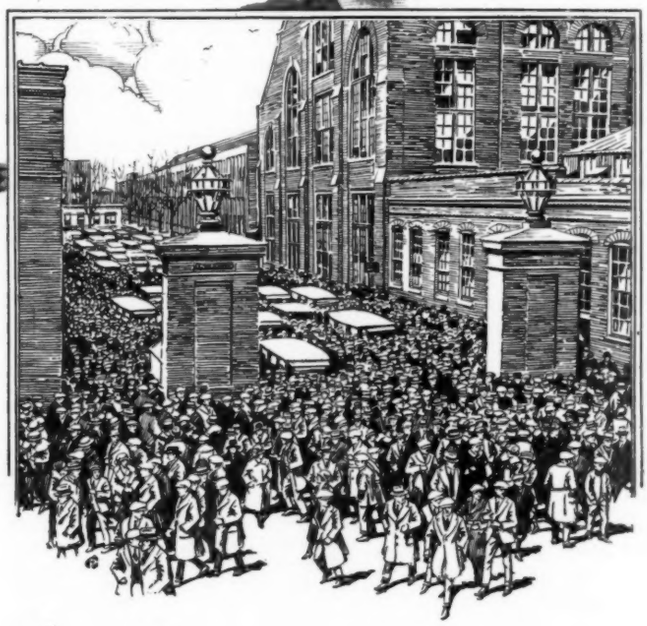
Since 1877 Western Electric has been alert to serve the requirements of the country for telephones. We will now be ready for even greater developments to come.

**The largest is the Western Electric Works in Chicago*

The great Works now building, as it will look when completed. A part of this plant is scheduled to be in production before the close of 1924.



10,000 miles of telephone cable a year! Such was the output of the Hawthorne Works in 1923. Our new shops will help produce a still greater mileage.



As building progresses, men and women by the thousands—in truth a cityful as at Hawthorne—will be busily employed here making telephone equipment.

Western Electric

SINCE 1869 MAKERS OF ELECTRICAL EQUIPMENT

usually be sufficient. In inspecting this class of plant, careful attention should be given to the cable where it enters the ducts, where cracks frequently develop.

Splices should be carefully inspected for cracks at the ends of the wipes and all lateral cables securely lashed to the main cable. Special attention should be given to see that all cables are supported on racks or hangers where they pass through the manholes.

An important item in underground cable inspection is testing for the presence of foreign current on the cable sheath. It frequently happens that stray currents from power or trolley systems find their way back to the generator by way of the underground cable system. Wherever this current leaves the sheath of the cable in moist earth, the sheath is destroyed by electrolytic corrosion.

It is, therefore, necessary for telephone companies to protect their cable by bonding them together and providing a suitable metallic drain in order that the cables may be kept negative to all surrounding structures. The amount of current drawn from the cables should be limited by the use of resistance and these should be adjusted so that as small a current as possible is drained from the cables to produce a negative condition on the cables.

On the completion of the inspection, a summary of the defects found may be compiled and arrangements made to take care of all items which were not completed at the time that the inspection was made. The value of the inspection may be obtained by comparing the faults found on the inspection with a record of the trouble before and after the inspection, and the time between the inspections may be regulated by comparing the results of succeeding inspections.

Every exchange should maintain a complete record of its cable plant. This record should consist of a plat, showing the complete distribution system on which the sizes, gauge and lappings of all cable and terminals are shown. A record should be kept of the conductors, which should show the lapping taken by each terminal and the terminal and conductors on which each line works.

These records are of great value in making assignments and rearrangements of subscribers' lines, in making studies of plant growth, and in enabling cable men to quickly locate trouble and restore service when cable failures occur.

The subject of testing and locating cable trouble is so large and varied that time will not permit a general discussion of it now. Each case must be considered on its own merits, and the methods employed vary with the conditions.

Commissions, Courts and Councils

Discussions and Rulings of State Bodies Having Supervision Over Telephone Companies—Decisions of Courts in Matters of Interest to Public Utilities and Actions of City Councils Relative to Franchise, Rates and Service

Motion to Dismiss Peoria, Ill., Injunction Suit Denied.

Motion to dismiss an injunction suit obtained by the City of Peoria, Ill., against the Illinois Bell Telephone Co., restraining the telephone company from raising rates to Peoria and neighboring villages was denied by Judge John M. Niehaus, in the federal district court of Peoria on May 12.

In November, 1922, a temporary restraining order was granted in the circuit court, forbidding the telephone company to increase its rates until a decision was obtained from the Illinois Commerce Commission, before which the legality of the increase was pending.

When appealed to the appellate court, the decision of the Peoria county court was affirmed and the temporary injunction was allowed to stand, it still being in effect.

Through a motion filed to dismiss the suit, the telephone company hoped to obtain the opportunity for increasing its rates. They contend at the present rates they are operating at a yearly deficit of $4,000. The motion set up that the suit was without equity, that the injunction itself was unjust.

In his decision on the motion, Judge Niehaus held that the matter of equity in the rate case was a proposition for the Illinois Commerce Commission to decide, and that the only question before the circuit court of Peoria county was a question of law.

"The law expressly states that no increase can be had by a public utility until a decision is received on the legality of the rates from the commission. When the legislature repealed the public utilities act and passed the present act, they left that clause out of the bill, but inserted, however, a saving clause which preserved that clause as applied to all cases then under consideration. As this case was then under consideration, I am of the opinion that the rule applied to this case, and that the injunction was granted in a valid manner. I am therefore compelled to overrule the motion," the judge stated.

To attorneys for the telephone company, he explained that if they felt they were being unjustly dealt with and that the commerce commission was delaying them in granting permission to exercise their rights, their proper quarrel lay with the commerce commission to act on a rate case within a reasonable length of time.

To Serve Cologne Patrons from Norwood (Minn.) Exchange.

The Carver County Telephone Co. was given permission by the Minnesota Railroad & Warehouse Commission, on April 29, to discontinue the operation of its central office at Cologne and to provide service to its subscribers in that village and vicinity over individual and party lines from its Norwood exchange.

The Cologne exchange serves approximately 36 town and 144 rural stations. The petitioner testified at the hearing in this proceeding that it has operated this exchange at a loss of from $900 to $1,000 during the years of 1922 and 1923, and company hopes to overcome this loss by connecting the Cologne lines directly to the switchboard at Norwood, which will permit of doing away with the expense of operating the central office at Cologne.

In order to make the change proposed, an expenditure of approximately $9,000 will be necessary in order to provide cable and open wire facilities between Norwood and Cologne.

It was proposed by the petitioner that the same rates apply at Cologne, except that the service be rendered over four-party lines instead of individual lines. Certain subscribers objected to the proposed plan and requested that provision be made so that individual line service could be obtained by those who desire it. In order to meet this demand the petitioner filed, in addition to the regular schedule, rates for one and two-party business and residence service and a rate for joint user service.

Following is the gross monthly rate schedule for Cologne and vicinity as approved by the commission:

Individual line, business	$6.75
Two-party line, business	4.25
Four-party line, business	2.50
Individual line, residence	6.25
Two-party line, residence	3.25
Four-party line, residence	1.50
Rural multi-party line	1.75

Joint use business and residence service on the same line for the same individual or company, $7.25 per month, gross.

Two-party service is to be rendered only when two parties are available for such service on one circuit.

The gross rates quoted are to be subject to a discount of 25 cents per month for prompt payment.

Map showing location of public utility properties appraised by The American Appraisal Company

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Commissioner as Arbiter in Dispute Between Stockholders.

Commissioner Randall of the Nebraska State Railway Commission sat as arbiter in a dispute between the stockholders of the Union Mutual Telephone Co., located at Union, Neb., which is owned by business men and farmers alike. The company's property is requiring heavier maintenance expenditures and it is necessary to get more revenue. The farmers proposed that their rates be left as they now are and that the increased revenue be all contributed by the business men. The latter insisted that it be spread on every subscriber, and protested that it was discrimination to charge them more than the farmers paid.

The company was organized 19 years ago, with 80 stockholders. It has never paid a dividend, early profits going into new construction. Some holders began selling their stock, and the number has been reduced to 40. The company has been charging $1.25 a month to each subscriber alike, and furnishing service to non-subscribers on the same liberal basis. It is now proposed to charge business men $2 a month.

Farm Mutual Refuses Responsibility for Toll Charges.

A farm mutual telephone company that is switched at Fullerton, Neb., by the Northwestern Bell Telephone Co. has put up a new problem to the state commission. The farm company is being denied the renewal of a contract with the Bell in which it stipulated that no long distance calls were to be sent over its line.

The company has no organization for the purpose of collecting tolls from its members and, rather than be responsible for the charges on these, it has refused to accept any toll calls originating on its lines or terminating there. When a call came from the outside, it merely reported that the person had no telephone.

This means a curtailment of service to which the Bell is no longer inclined to consent, especially as it limits the revenue available as the result of the connections given. It is insisting that the company shall hereafter accept or forward all long distance calls, and that the new contract contain a stipulation providing for the payment of these by the rural company in one form or another. It maintains that the attitude of the farmers' company is in essence a denial of service.

Hearings in New York Rate Case Completed Before Commission.

Hearings on the New York Telephone Co.'s original application for a temporary increase in New York City telephone rates practically were completed before the New York Public Service Commission on May 22, although the right was granted to the company to examine the testimony and data presented that day by Assistant Corporation Counsel M. M. Fertig in closing the city's case.

Much of the city's testimony dealt with the costs of telephone maintenance and central office equipment, and was presented by James G. Wray, consulting engineer. Mr. Wray drew the conclusion that central office maintenance expenses should come down in the near future, and that a saving of about $60,000 a month could be made, due to the introduction of automatic equipment.

On cross-examination by Frankland Briggs, attorney for the telephone company, the witness admitted that the only way this saving could be effected was by discharging about 500 employes engaged in this work, despite the fact that the company plans to open at least 26 new central offices in the greater city in 1924 to meet the demands for service.

George W. Whittemore, valuation engineer, appeared for the telephone company to disprove certain theories advanced by the city's witnesses on the depreciation of the company's property. Mr. Whittemore refuted the testimony of Milo R. Maltbie, witness for New York City, that the company was duplicating its charges for depreciation.

The hearings in this case were formally concluded at noon Friday, May 23. Briefs are to be filed by the company and the city of New York not later than June 9.

Harland A. Trax, chief accountant of the telephone company, gave testimony at this session refuting the allegations made by Milo R. Maltbie, witness for the city, that the company was "duplicating" its depreciation charges. Mr. Trax submitted exhibits showing that Mr. Maltbie had failed to include in his calculations several important items of operating expense.

Mr. Trax also submitted an exhibit which showed that, based on Mr. Maltbie's own deductions and accepting the commission's method of fixing the valuation of the company's property and allowing the commission's 7 per cent rate of return, the company's deficit for 1924 would aggregate $5,583,977. The company's estimate of this deficit is $7,500,000.

Decrease in Switching Charges at Grafton, N. D., Denied.

The North Dakota Railroad Commission in denying the petition of the Grafton Rural Telephone Co. last month for an order reducing the present charge of the Northwestern Bell Telephone Co. of $6 per year per subscriber, for furnishing the complainant's switching through its Grafton exchange, held, as follows:

"That while the commission was not unmindful of the fact that depressing conditions had prevailed among the farmers, not only in North Dakota, but in agricultural communities generally, the slight reduction in telephone switching charges would not materially change the situation as far as petitioners were concerned, and since the present revenue of the company did not produce an unreasonable return and the rate for switching service at Grafton was not out of line with that charged for similar service at other exchanges of like size and character, the petition of the Grafton Rural Telephone Co. for a decrease in switching charges should be denied without prejudice."

Summary of Commission Rulings and Schedule of Hearings.

INTERSTATE COMMERCE COMMISSION.
WASHINGTON, D. C.

May 12: The United Telephone Co., Abilene, Kans., requested authority to purchase properties of the Consolidated Telephone Co. and the St. Francis Telephone Co.

May 16: Application filed by the Bell Telephone Co. of Pennsylvania for authority to purchase certain properties of the Petroleum Telephone Co., of Oil City, for a consideration of $32,354. At the same time the Petroleum company asks for permission to purchase certain properties of the Bell company for $190,000.

CALIFORNIA.

May 20: Application filed by the California Telephone & Light Co. for authority to issue and sell $200,000 of its first mortgage, 6 per cent, gold bonds maturing April 1, 1943, at not less than 95 per cent of face value, plus accrued interest, and to use the proceeds to reimburse its treasury on account of expenditures for capital purposes.

May 20: Application filed by the Valley Telephone Co. for authority to re-establish telephone service in certain portions of Lassen county and to exercise a franchise granted by board of supervisors of Lassen county to the Honey Lake Valley Mutual Telephone Association.

ILLINOIS.

May 15: The commission approved an agreement between the Commercial Telephone & Telegraph Co., of Olney, and the Illinois Bell Telephone Co. under which the Bell company absorbs the Commercial company's exchanges and business at Carlyle, Beckemeyer, Breese, Aviston, Trenton, Germantown, Salem, Kinmundy, Enfield, and Norris City and certain toll lines in St. Clair, Clinton, Marion, Jefferson, Wayne, Hamilton, White, Saline, Gallatin, Pope and Hardin counties.

The Illinois company is to pay $190,000 for this property and also relinquish to the Commercial company toll lines in Wabash, Wayne, Richland, Lawrence, Jasper, Crawford and Clay counties.

The 10 exchanges to be transferred by the Commercial company serve 1,698 company owned and 463 subscriber-owned stations.

May 28: Hearing at Chicago in re application of the Morrison Telephone Co., of Morrison, for authority to issue $50,000 of common capital stock. No. 14120.

INDIANA.

May 15: Petition filed by the Indiana Bell Telephone Co. for permission to purchase the Citizens Telephone Co., of Columbus. It is understood that the majority of the stock of the Citizens company is already owned by the Bell company.

KANSAS.

May 6. The commission dismissed the petition of the patrons of the Herington Telephone Co., of Herington, for the

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It is used for all switchboard work, especially for jumper or bank wiring, and automatic switchboards. Automatic switching demands absolute moisture proofing. All other switching should have the same protection. The No. 22 conductor is tinned and coated with Beldenamel. Two servings of silk and one of cotton are applied and coated with a special moisture proof compound, followed by a cotton braid saturated in flameproof compound.

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Belden Switchboard Wire consists of solid copper wire, insulated with two or three servings of silk and cotton applied in reverse directions, and saturated in paraffine compound.

This wire is made in eight colors. Single conductor, No. 22, is generally used and stocked. Other sizes can be made to order.

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restoration of free service between the Delevan and Lost Springs exchanges and the Herington exchange; the commission held that it had no power to compel telephone companies to erect and maintain free trunks between their exchanges.

KENTUCKY.

May 16: Order issued authorizing the Cumberland Telephone & Telegraph Co. to sell its exchange at Munfordsville to George T. Tucker.

MISSOURI.

April 22: The Daviess County Telephone Co., of Gallatin, Mo., was authorized to charge a flat rate of $2.75 per month for business wall telephones; $3 for business desk sets; $1.50 for wall residence and $1.75 for desk residence telephones. It was erroneously stated in last week's issue that the rates approved by the commission were $2.50 for business and $1.25 for residence service.

MONTANA.

April 28: The commission authorized the Lakefield Telephone Co., of Lakefield, to place in effect as of May 1 the following schedule of increased rates: Individual line business, $2.50 per month gross, $2.25 net; two-party line business, $2.25 gross, $2 net; individual line residence, $1.50 gross, $1.25 net; two-party line, $1.25 gross, $1 net; rural switching, 35 cents per month net. M-1227.

NEBRASKA.

May 19: In the matter of the application of the Callaway and Arnold telephone companies for permission to reduce the rate to certain parties having no telephones directly connected with the exchanges of the two companies from $8 a year to $6, so as to equalize the rates charged at the Callaway exchange with those charged at Arnold; found reasonable and permission granted. A toll line connects the two exchanges and it is this with which the non-subscribers are in touch. The rate is substantially a yearly toll charge for the two exchanges' service.

May 20: Application of the Cloudy Telephone Co. of Dodge for permission to issue $900 worth of stock, found reasonable and permission granted. This is a farm-line company that has been a mutual and desires to go on a commercial service basis. The stock allowed represents the estimated amount invested in the line.

May 20: Application filed by the Northwestern Bell Telephone Co. for permission to reduce P. B. X. charges in connection with sleeping rooms in clubs.

May 20: Application filed by the Lincoln Telephone & Telegraph Co. for permission to make free service with Shelby exchange optional with subscribers to Rising City exchange.

May 20: Complaint filed by West Newman Telephone Co., of Fullerton, against Northwestern Bell Telephone Co., alleging that it refuses to renew contract for no toll service.

May 23: In the matter of the application of the Chester Telephone Co. for permission to increase rates; held that the showing justifies the request in the manner and form asked, and order issued accordingly.

May 23: Application filed by the Hardy Telephone Co. for permission to increase rates on ground that present schedule is inadequate.

May 23: Application filed by the Byron Telephone Co., alleging that the present schedule of rates is inadequate.

May 23: Complaint filed by the Comstock Telephone Co. against the Crownover Telephone Co., alleging that the present commissions paid for the handling of toll messages are inadequate and asking for 40 per cent.

June 11: Hearing at Crawford in re application of Northwestern Bell Telephone Co. to increase rates at Belmont and Whitney.

NEW YORK.

May 15: The commission approved a new rate schedule for the Black River Telephone Co., of Lowville, effective June 1.

July 10: Continued hearing on the complaint of Mayor Cosgrove, of Cohoes, against the New York Telephone Co., in which he alleges that there is a discrimination in toll rates between Cohoes and Albany and Troy.

OKLAHOMA.

May 21: Gould Telephone Co. given authority to increase its rates.

PENNSYLVANIA.

April 29: The commission dismissed the case of the Selinsgrove Chamber of Commerce, et al. vs. the Middlecreek Valley Telephone Co. and the Bell Telephone Co., of Pennsylvania, et al. The commission held that it was a recognized principle of telephone operation and rate-fixing that the territory served by a company must be divided into "homogeneous and restricted areas," each having a community of interest requiring telephone communication, which principle made possible the most effective service at the lowest rates consistent with operating conditions, and since it was evident that the three communities in question did not constitute a homogeneous local area, the toll rates filed by respondent companies for calls between Selinsgrove and Sunbury and between Selinsgrove and Northumberland, were fair and reasonable. C-5900 and C-5915.

May 15: The Mt. Air Telephone Co., furnishing service in North Beaver, Little Beaver and Beaver townships, Lawrence county, filed a new tariff to become effective June 15, which increases the rental rates per annum for multi-party line service from $18 to $24.

WISCONSIN.

May 20: In re proposed extension of the Boyceville Telephone Co. in the town of Hay River, Dunn county; commission found that public convenience and necessity do not warrant the construction of the proposed extension and denied permission to the commission to extend its lines as proposed. T-1119.

May 22: The commission authorized the Commonwealth Telephone Co. to increase its rates for telephone service at Mineral Point. U-2979.

May 23: In re complaint of H. O. Churchill et al. vs. the Highland Telephone Co. and the Grange Hall Telephone Co., alleging that disconnection of Highland line No. 6, at Rock Elm exchange of the Grange Hall company has caused great inconvenience and annoyance; the commission ordered the Highland company to maintain a direct connection between the line in question and the switchboard of the Grange Hall company at Rock Elm; the Highland company to pay the Grange Hall company a monthly switching fee of 25 cents per month per subscriber for each subscriber connected to that line. U-3006.

May 26: Hearing at London in re alleged refusal of the Cambridge Telephone Co. to extend service to Neupert & Febock, et al. U-3025.

May 26: Hearing at Hudson in re application of the Hammond Telephone Co., of Hammond, for increase in rates.

May 28: Hearing at Grantsburg in re application of the Wisconsin Telephone Co. to increase its rates at its Grantsburg exchange. U-2950.

June 5: Hearing at Marshfield in re application of the Auburndale Telephone Co., of Auburndale, to increase rates. U-3024.

June 6: Hearing at Independence in the case of the Independence Telephone Co. vs. the Western Wisconsin Telephone Co., as to physical connection charges. U-3032.

June 9: Hearing at Fond du Lac in the case of W. K. Porter, et al. vs. the Fond du Lac Rural Telephone Co., the VanDyne Telephone Co. and the Wisconsin Telephone Co. U-2852.

June 10: Hearing at Mt. Hope in re investigation of commission as to alleged failure of the Peoples Telephone Co., of Mt. Hope, to comply with order of February 12, 1923, regarding service and accounting. U-3028.

June 12: Hearing at Madison in re application of the New Cashton Telephone Co., of Cashton, to increase switching service. U-3043.

June 13: Hearing at Madison in re application of the Sturgeon Bay & Gardner Telephone Co., of Gardner, to increase rates. U-3047.

June 13: Hearing at Madison in re application of the Price County Telephone Co., of Phillips, to increase rates. U-3048.

From Factory and Salesroom

Strowger 700-Line Automatic Switchboard for Sparta, Wis.

The Monroe County Telephone Co. has placed orders with the Automatic Electric Co. for a 700-line automatic switchboard of the standard Strowger type for Sparta, Wis.

Previous to the placing of the order, a demonstration switchboard was placed on display and the Sparta subscribers invited, through newspaper announcements, to call and see the equipment in operation, so that they would be in a position to make an intelligent decision as to their preference.

The switchboard, as initially installed, will consist of 700 standard plunger type line switches, seven groups of connectors, together with the associated selector trunking equipment for selecting the desired hundred group of lines.

The party line units (the 600, 700 and 800 units) will be equipped with standard ten-party connectors. These connectors

will be of the familiar frequency-selecting type adapted to full automatic selection on party or rural lines with as many as ten stations per line, by the use of five ringers adjusted to respond to give different frequencies of ringing current and connected between one side of the line and ground.

The 300, 400 and 500-line units will be equipped with regular single-line connectors and used exclusively for single-line service.

The 200-line unit will be equipped with P. B. X. connectors, arranged for automatic selection of the first idle line in a group. While these connectors are designed primarily for P. B. X. users and other subscribers using more than one line with only one directory number, they are also used with equal facility for single-line subscribers and for the automatic selection of trunks to the toll or rural operator.

In case the single-line units become filled to capacity, the P. B. X. and party-line units can be used to take care of single-line traffic. In this way all of the subscribers' line equipment can be utilized to its fullest efficiency, resulting in a very efficient arrangement.

For the present, the rural lines will be handled manually. A two-position toll and rural desk will be installed, for the purpose of handling all calls requiring the worries of an operator.

From each of these two positions, ten service trunks will lead to line switches, giving the toll and rural operators access to automatic subscribers through the automatic switching equipment.

Subscribers desiring to make toll calls will be instructed to dial 211. Doing this will connect them with the toll operator who will set up the connection in the usual manner.

Connections from automatic to rural subscribers will be taken care of in a similar way, except that the calling subscriber will dial 221 to secure a trunk to the rural operator, who will set up the connections to the rural subscribers manually.

Sparta subscribers will also be able to signal the operator at the small magneto exchange at Cataract, Wis., by dialing 241.

A standard wall test cabinet, containing all of the approved apparatus for testing outside plant will be installed. A trunk from the test cabinet will lead to a test distributor from which in turn trunks will lead to the test connector, one of which will be mounted on each line unit.

The Monroe County Telephone Co., as well as the telephone subscribers of Sparta, will have good reason to be proud of their plant when the new installation is completed and cut into service. It will be as up to date as the best in the country and in line with the developments in large and small cities throughout the world.

Howard Teasdale is secretary and manager of the Monroe County Telephone Co.

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FOLLOW the progress of telephone practice from the early days of makeshift equipment to the present era of skilled workmanship and you will find that "National" telephone specialties have more than kept pace with development.

Today the National Cable Ring upholds family tradition and proves to be a "still better" cable ring. Despite its tense gripping ability it submits easily to instant installation.

Wide space between prongs allows full facilities for reclipping.

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Orders Strowger Automatic for San Bernardino, Cal.

Three years of experience in the operation of Strowger automatic equipment at Long Beach, Cal., has apparently convinced the Associated Telephone Co. of the merits of that system, for it has just placed orders with the Automatic Electric Co. for similar equipment for its Bernardino exchange. The new switchboard will have an initial capacity of 2,500 lines.

The success of the Associated Telephone Co. is indicated in the recent report of President George B. Ellis to the stockholders, in which he states:

"Your industry for the year 1923 has by far exceeded the 1922 record and with the continued growth of our wonderful southland we predict that the coming year will show even greater growth. Operating expenses, including maintenance and depreciation, have been reduced to 54 per cent of gross income and this saving provides more than the requirements for interest on additional investment due to the automatic installation."

Paragraphs.

HARRY S. YOUNG, telephone sales supply manager of the H. C. Roberts Electric Supply Co., of Philadelphia, Pa., is seriously ill, having been confined to his home for several months. His many friends in the telephone industry, particularly in the East, will be sorry to learn of the seriousness of his condition.

Pegu and Rangoon, Burma, Connected by Direct Telephone Line.

Announcement has been made of the opening of a direct telephone line from Pegu to Rangoon, Burma. Extension of this line to Mandalay is under contemplation. This work is in accordance with the policy of the Posts & Telegraph Department of the Government of India, in extending telephone lines.

Nebraska Association's Field Secretary Assisting in Rate Cases.

The first fruits of the employment by the Nebraska Telephone Association of a field secretary are in evidence. Three days after the application of the Chester Telephone Co. for an increase in rates was presented to the state railway commission, an order was issued granting what was asked for. George H. Presson, the field secretary of the Nebraska association, counseled the action taken, helped prepare the case and assisted in its presentation.

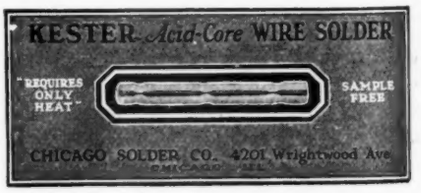
Immediately following this hearing, applications for increases were filed by the Hardy and Byron companies, counselled by Mr. Presson, who is giving the benefit of his knowledge and advice to the smaller companies that have not only dropped out of the dividend-earning class, but which are having hard work to make operating expenses. In some cases this is possible only through the sacrifices of the officers and others in the matter of salaries. In all three of these cases the companies have not had any change in rates for years, in two of them none since when they started something like 20 years ago.

The Chester company was started as a partnership with a capital stock of $14,000. It has paid dividends of from 3 to 10 per cent, but the officers have cut their salaries or donated their services in recent years to make this possible.

The commission found that the early surplus earned was used up by a failure to earn a reasonable amount for replacements during the abnormal price period of the last six years. The company now faces a $4,000 reconstruction program, with insufficient money to finance it. This includes metallizing lines.

The original cost of the plant now in use was $22,693, but it has depreciated to a value, the commission engineers found, of $15,343. The gross revenues for 1923 were $4,763; operating expenses, $4,259, leaving but $289, after taxes were paid, for interest and dividends.

The company is authorized, under the order effective June 1, to increase gross business rates from $1.75 to $2.25; residence from $1.25 to $1.50; farm, grounded, from $1.25 to $1.50; extension sets, 50 cents; extension bells, 15 cents; desk sets, 25 cents; advertising line ring, $1.25, with special lines rates increased accordingly. No change was made in the $1.50 metallic



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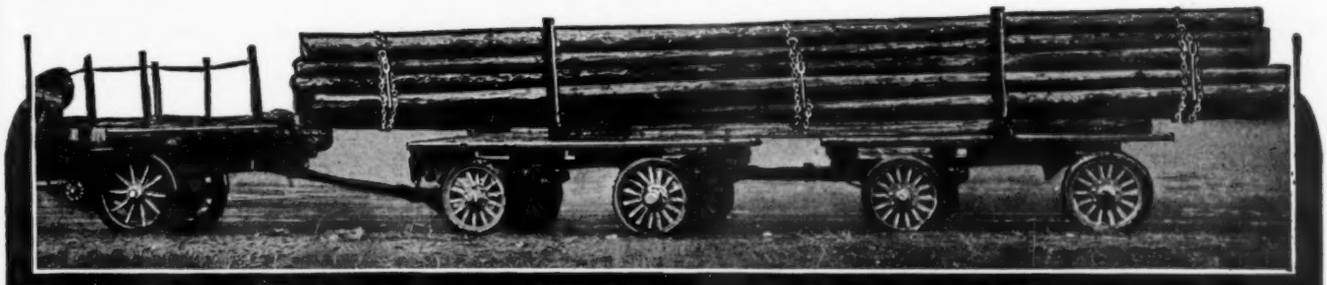

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MR. EUGENE C. STACY,
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Dear Sir:—I will state the question of using the Load Binder, as described in your circular, was taken up at our Accident Prevention Committee Meeting and everybody agreed that they were O. K., and instructions have been issued to order as many as necessary.

The Chairman of the General Accident Prevention Committee has been trying them out, and my last report was that they were entirely satisfactory and that they would be made standard and would replace all boom poles.

If you have not received any orders direct, you will probably receive same from the Western Electric Company, as all of our material is ordered through them.

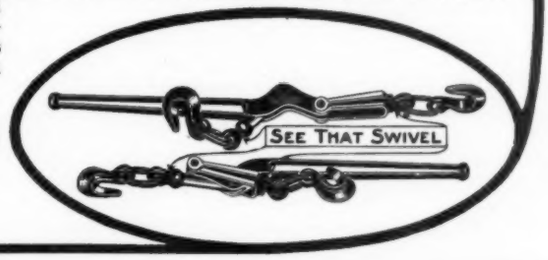
Yours very truly,
(Name on request)
Dist. Superintendent of Plant.

Telephone companies find Stacy Load Binders big time and labor savers—also a big factor in preventing serious and expensive accidents caused by loads slipping. You simply pass chain around load—hook the ends of the Stacy Binder in links of chain—one pull of the handle and load is bound securely and safely—one man can bind any load in a jiffy.

Safer—Easier—Quicker

Stacy Load Binders are built strong and durable—last indefinitely—never break. Made in two sizes. Regular size and Jumbo size. Regular size sells for $2.50 each, $5.00 per pair. Jumbo size $3.75 each. $7.50 per pair. Sold by leading hardware dealers and hardware jobbers—if yours can't supply you order direct from

Eugene C. Stacy,
Manufacturer
Tiffin, Ohio



DIG IN with IWAN

The Auger that has strength and durability. Their large cutting surface and capacity furnish the speed to keep the diggers ahead of the pole setters. This means less time wasted, less man power and less waste of profits. Other telephone companies using IWAN AUGERS find this to be true.

Our booklet on digging tools will show how we can increase the efficiency of your maintenance men.

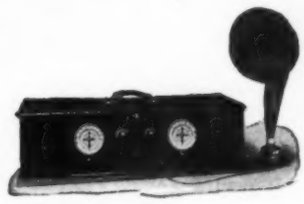
IWAN BROS.
SOUTH BEND, INDIANA
U. S. A.

Radiola Super Heterodyne, with Radiola loud speaker, and six Radiotrons UV-199. Entirely complete except batteries,

$286

Batteries Necessary

6	No. 7111	"A"	$ .40 each
2	No. 767	"B"	5.00 each
1	No. 771	"C"	.60 each



The New Radiolas Are Here!

Selective, non-radiating, simple to operate, delivering great volume, using dry cell tubes.

Illustrated above is Radiola Super Heterodyne. Assures long distance reception on loud speaker using **no antenna** and **no ground.** Loop is self contained in cabinet.

"THERE'S A RADIOLA FOR EVERY PURSE"

$35	ILLINOIS ELECTRIC CO.	$425
$65	CHICAGO — LOS ANGELES	$286
$100	Distributors for Radio Corp. of America Zenith Radio Corporation	$245
$150	$206	$220

Please tell the Advertiser you saw his Advertisement in TELEPHONY.

farm rate. These increases will add about $1,000 a year, and will put the company on a dividend-paying basis.

The commission has repeatedly said that it stood ready to give adequate rates to any company which could make a legal showing. Mr. Presson is working to bring about this condition among the smaller companies, to demonstrate the worth of the state association, among other things, to these organizations and to raise the rates to a general standard.

The fact that inadequate rates exist at so many points where inertia or lack of knowledge of how to get proper schedules has made it difficult to educate the people generally to what are proper and remunerative rates. Because these conditions existed objectors, however ignorant the parties were of the actual facts, could point to them as furnishing service at low rates and as having paid big dividends in the past.

HELP WANTED

WANTED—All-around rural lineman. Man who can take care of line trouble, repair telephones and do switchboard work. One who is willing to look after the interest of the telephone system and give service. Have a good, permanent place for the right man. My last man was with me for fourteen years. Have a good telephone system. Need good, steady man. Write to F. B. Sprague, Corning Telephone Co., Corning, Ark.

POSITION WANTED

POSITION WANTED—By an experienced magneto troubleman and manager. A real hustler. Iowa or Nebraska location preferred. Address Frank Nicklas, Ackley, Iowa.

WANTED

WANTED—Cable work. Will locate and clear trouble in old cables or splice and connect new cables. Write or call H. B. Crandell, Springfield, Ill.

Telephone Companies will do well to consider this exceptional offer

NO. 17 COPPER CLAD DROP WIRE

rubber covered, weatherproof insulated. standard and perfect, coils 500 ft.

$8.50 per 1000 feet

(f. o. b. Harrisburg, Penna.)

Quantities 5000 ft. or more.
Terms sight-draft BL attached.

W. W. JOHNSTON
220-221 District National Bank Bldg.
Washington. D. C.

CABLE TESTER

Have a "STEWART" Cable Tester on hand for the spring and summer rains, and be prepared for that wet cable.

It has two vibrators and gives out either high or low pitch current, by simply throwing switch.

The most complete Cable Tester built, and will locate all kinds of cable trouble except opens.

Sent on trial

STEWART BROTHERS
OTTAWA ILLINOIS

Specify ROEBLING TELEPHONE WIRE

E. B. B., B. B., **and Steel Grades**

JOHN A. ROEBLING'S SONS CO.
TRENTON, NEW JERSEY

PURE WATER
For 2 Cents A Gallon

PEERLESS AUTOMATIC WATER STILL

Purify water regardless of its condition and make it fit for battery, medical, chemical and drinking purposes.
AT A COST OF 2 CENTS A GALLON

Illustration shows still taken apart for cleaning—simple to install, simple to operate. Gas and electric models from $20 to $50. Write for data now.

SPARTA MFG. CO.
111 South Hill Street **South Bend, Indiana**

North

The North Line offers every kind of automatic telephone service, including the Automanual System for local and toll service, Automanual Remote Control of small exchanges and Dial Automatic for both private exchanges and central office equipment.

The North Electric Manufacturing Company
Galion, Ohio
Manufacturers of Telephone Equipment Since 1884

Note Protection at Corners

Blake Insulated Staples

Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds.

4 Sizes **Pat. Nov., 1900**

Write for Samples

Blake Signal & Mfg. Co.
BOSTON, MASS.

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